PATTERN AND PROGRESSION OF CHRONIC KIDNEY DISEASE IN A GROUP OF PATIENTS IN SULAIMANI CITY

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Submitted: 3/1/2023; Accepted: 25/7/2023; Published: 21/12/2023

ABSTRACT

Background

Chronic kidney disease (often underdiagnosed, and its complications often undertreated) is a worldwide public health problem associated with a significant increase in mortality.

Objective

To find out the common causes of chronic kidney disease in Sulaimani to prevent and accurately assess risk factors for target intervention to prevent or slow down the progression.

Patients and Methods

An observational case series study was accomplished on 192 patients with chronic kidney disease in Sulaimani City from September 2018 to March 2019. Following informed consent, a questionnaire collected demographic and clinical details. Laboratory data of the patients were also collected and statistically analyzed.

Results

The majority (58.9%) of the participants were 18-64 years old, 66.7% lived in urban areas, and 66.1% had a low socioeconomic status. The leading causes of chronic kidney disease in children were glomerular diseases (45.4%) and congenital urological malformations (31.8%), while in adults and elderly group, diabetic nephropathy (25.9%), glomerular diseases (19.4%), and hypertension (16.5%) were the most common causes. About 50% of all patients were diagnosed when they reached advanced stages (stage IV, V), and about 90% of patients diagnosed at early stages progressed to advanced stages. Uncontrolled diabetes, proteinuria (≥ 1gm), and uncontrolled blood pressure were significant risk factors for progression.

Conclusion

Chronic kidney disease is underdiagnosed and undertreated in our region. Early detection and measures to slow disease progression should be encouraged.

Keywords: *chronic kidney disease, predictors, progression, risk factors for progression.*

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https://doi.org/10.17656/jsmc.10438

INTRODUCTION

Chronic kidney disease (CKD) is a public health problem that needs concern due to associated clinical outcomes (cardiovascular events, death, and all-cause hospitalization), poor quality of life, and the high cost of disease management [1].

Hypertension and diabetes (chronic non-communicable diseases) are the leading causes of chronic kidney disease worldwide. In contrast, chronic glomerulonephritis and interstitial nephritis are the leading causes in developing countries, reflecting the high prevalence of bacterial, parasitic, and viral infections (communicable diseases) [2]. The clinically undiagnosed CKD can lead to progression to end-stage renal disease (ESRD), which usually requires dialysis treatment or kidney transplantation and carries a significant healthcare burden. Therefore, it is essential to determine the risk factors to minimize the progression of the disease [3].

Risk factors of CKD are susceptibility factors that increase the risk of kidney damage, such as advanced age, family history, and low birth weight (reduced kidney mass). Initiating factors that directly cause kidney damage include diabetes, hypertension, autoimmune diseases, urinary tract infections, urinary stones, lower urinary tract obstruction, and drug toxicity. Also, high levels of proteinuria, high blood pressure levels, poor blood sugar control in diabetes, and smoking are among the factors that accelerate the decline of kidney function after the onset of kidney damage [4].

Because early detection may help prevent the progression of CKD and improve survival, surveillance programs are encouraged worldwide [5]. Therefore, the objectives of this study were to find out the common etiologies of CKD in Sulaimani Governorate and the prevalence of different stages of CKD. Also, an accurate assessment of the risk factors was conducted to prevent or slow down the progression to end-stage renal disease.

MATERIALS AND METHODS

Design, samples and setting

An observational retro-prospective case series study (review of cases) was conducted. A convenient sampling method was used to select participants from 7 hospitals and two health centres. Data were collected from September 2018 to March 2019, and the study included patients with established CKD (diagnosis confirmed by a nephrologist or clinician) who were living in Sulaimani Governorate from all age groups but excluded those who were already on dialysis courses and those who underwent kidney transplantation. The total number of the collected patients was 192 patients.

Verbal consent was obtained from the patients during visits to hospitals and outpatient clinics. Then, demographic, clinical and health-related information was collected using a self-made questionnaire by the researcher.

Demographic characteristics, including gender, residency, and age, were investigated. Age categories into three groups, including children and adolescents (under the age of 18 years), adults (18-64 years), and elderly (≥ 65 years old) [6]. Also, we inquired about education level, employment, and marital status to decide the SES (socioeconomic status) using equation (1) [7]: *SEI (socioeconomic index) = education + occupation + (house owner * 0.5) + (car owner * 0.1) + (age – 20 /100) – (retired / unemployed/deceased)* (1)

SEI value up to 5 were considered low socioeconomic status, 5-10 as middle SES, and above ten as high SES.

Clinical variables

Clinical variables included inquiring about the positive history of chronic diseases such as diabetes mellitus and hypertension (duration of the disease and if controlled or lack of control before the development of CKD). In addition, we asked about the history of acute kidney injury (abrupt oliguria or anuria) and whether the patient had a single kidney and the cause behind it, such as congenital agenesis, nephrectomy, or kidney donation.

The physical examination variables

Blood pressure was one of the physical examination variables. According to the American College of Cardiology/ American Heart Association 2017, the target blood pressure in patients with CKD was less than 130 over 80 [8]. Body mass index (BMI) was another physical examination variable calculated in adults using the equation (2):

$BMI = \text{weight in kg} / (\text{length in meter})^2$ (2)

The laboratory test variables

One of the laboratory test variables was the last HbA1c to find if the diabetes was controlled or not in the patients of CKD.

Kidney function was determined based on e GFR, which was calculated in adults (18 years and above) using the MDRD study equation [9] (modification of diet in renal disease study equation):

- *GFR = 175 * (standardized serum creatinine)-1.154 * (age)-0.203 * 0.742 (if female) * 1.212 (if black)* (3)

While in children and adolescents (1-17 years old) Schwartz equation was used [10]:

*GFR = 0.41 * height in centimetre/serum creatinine*(4)

Then, we determined the stage of CKD using the classification of the stages of CKD by KDOQI [11]. Patients with stage I and II should not be considered to have CKD unless there is evidence of markers of kidney damage such as abnormality in urine (persistent proteinuria, persistent hematuria after exclusion of other causes), structural abnormalities seen by imaging studies like polycystic kidney, and small echogenic kidneys or abnormalities in the composition of the blood and urine that defines 'tubular syndromes' as renal tubular acidosis [4], but K/DOQI classification does not apply to children under two years of age as GFR increase from birth and reaches normal adult values by two years of age; furthermore children born with major structural anomalies will be considered to have CKD before waiting three months for such a diagnosis [12].

Statistical analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 22). The Chi-square test of association was used to compare proportions. Fisher's exact test was used when the expected count of more than 20% of the table's cells was less than 5. A p-value of less than or equal to 0.05 was considered statistically significant.

RESULTS

Socio-demographic characteristics

The total number of patients with established CKD was 192. Their mean age + SD was 50.44 + 20.36 years, and the median was 55 years. The age range was 0.125 to 85 years. Table 1 shows that the highest proportion of patients (58.9%) were aged 18 to 64 years, and only 11.5% were aged less than 18 years. More than half (52.1%) of the patients were males. Around two-thirds of the patients (66.7%) were living in urban areas, and 66.1% of them were of low socioeconomic status. Only 2.1% of the patients were of high socioeconomic status.

CKD causes in children

The most common cause of CKD among children less than 18 years old was glomerular diseases (45.4%). Minimal change disease was the most frequent glomerular disease; the proportion was higher among rural than urban residents (37.5 vs. 21.4% respectively). The second most common cause was congenital urological malformations (vesicoureteric reflux, kidney dysplasia) (31.8%). The other causes were presented in Table 2, which shows no significant differences between the urban and rural residents regarding the cause of CKD (p = 0.135).

CKD caused in adults and the elderly

The most common causes of CKD among adults were diabetic nephropathy (25.9%), glomerular diseases (19.4%), hypertension (16.5%), unknown cause (14.7%) and polycystic kidney disease (7.6%), addition to other causes mentioned in Table 3 which shows no significant differences between the urban and rural residents regarding the causes (P = 0.219).

Progression of CKD by age, SES, and residency

Table 1 shows no significant association between the progression of CKD with age (p = 0.103), socioeconomic status (0.604), and residency (p = 0.052). Also, 50.3% of patients were diagnosed when they reached advanced stages (IV, V).

Causes of advanced stages

The causes recorded in the patients who were diagnosed with advanced stages of CKD are presented in Table 4, where it is evident that 29.8% of the causes are unknown. The most common cause was diabetic nephropathy (31%), followed by hypertension (11.9%).

Progression of CKD in diagnosed patients with CKD

Table 4 shows that the progression of CKD occurred in 90.4% of the patients who were diagnosed with early stages of CKD. No significant association was detected between the established CKD causes and the progression rate (p = 0.935).

Risk factors of CKD progression

As shown in Table 5, no significant association was observed between the progression of CKD and most of the risk factors studied. However, the evaluations of HbA1c, proteinuria and blood pressure showed that people with uncontrolled diabetes compared to the group with controlled diabetes. (33.3%) had progressed to advanced disease stages (p = 0.033). The same situation was seen in all people with proteinuria (≥ 1 gm) compared to 80% of people with low proteinuria (< 1 gm) (p = 0.03). Blood pressure was not excluded from this rule, so 98.3% of patients with systolic blood pressure and 97.8% of diastolic blood pressure progressed to advanced stages of the disease compared to 43% of patients with controlled systolic blood pressure and 79% of controlled diastolic blood pressure (p = < 0.001). Therefore, these cases were among the important risk factors recorded for the development of CKD in our sample.

Table 1. Socio-demographic characteristics of the patients and Progression of CKD by age, SES, and residency.

	Socio-demographic		Progression of CKD					
	No.	(%)	No	Yes	Previously diagnosed with advanced-stage	Diagnosed at the time of the study with advanced stage†	Total	P
			No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	
Age (years)								
< 18	22	(11.5)	2 (12.5%)	11 (68.8)	1 (6.3%)	2 (12.5%)	16 (100.0%)	
18-64	113	(58.9)	3 (2.9%)	45 (44.1)	29 (28.4%)	25 (24.5%)	102 (100.0%)	
≥ 65	57	(29.7)	3 (6.1%)	19 (38.8)	17 (34.7%)	10 (20.4%)	49 (100.0%)	0.103*
Socio-economic status								
Low	127	(66.1)	4 (3.5%)	49 (43.4)	31 (27.4%)	29 (25.7%)	113 (100.0%)	
Middle	61	(31.8)	4 (7.8%)	24 (47.1)	15 (29.4%)	8 (15.7%)	51 (100.0%)	
High	4	(2.1)	0 (0.0%)	2 (66.7)	1 (33.3%)	0 (0.0%)	3 (100.0%)	0.604*
Residency								
Rural	64	(33.3)	4 (7.4%)	20 (37.0)	12 (22.2%)	18 (33.3%)	54 (100.0%)	
Urban	128	(66.7)	4 (3.5%)	55 (48.7%)	35 (31.0%)	19 (16.8%)	113 (100.0%)	0.052
sex								
Male	100	(52.1)						
Female	92	(47.9)						
Total			8 (4.8%)	75 (44.9%)	47 (28.1%)	37 (22.2%)	167** (100.0%)	

*** By Fisher's exact test. Advanced stage means pre-failure stage IV or ESRD. **25 cases were not included because of the short duration of CKD (a few months), so we cannot decide whether there will be progression or not.**

Table 2. Established causes of CKD in children under 18 years old by residency.

	Residence						
	Rural		Urban		Total		
	No.	(%)	No.	(%)	No.	(%)	P
DM type I	0	(0.0)	1	(7.1)	1	(4.5)	
Congenital bilateral vesicoureteric reflux nephropathy	1	(12.5)	4	(28.6)	5	(22.7)	
Congenital bilateral kidney dysplasia	2	(25.0)	0	(0.0)	2	(9.1)	
Neurogenic bladder	0	(0.0)	2	(14.3)	2	(9.1)	
Focal segmental glomerulosclerosis†	0	(0.0)	1	(7.1)	1	(4.5)	
Minimal change disease†	3	(37.5)	3	(21.4)	6	(27.3)	
IgA nephropathy†	0	(0.0)	1	(7.1)	1	(4.5)	
Systemic lupus†	2	(25.0)	0	(0.0)	2	(9.1)	
Cystinosis	0	(0.0)	2	(14.3)	2	(9.1)	0.135*
Total	8	(100.0)	14	(100.0)	22	(100.0)	

*By Fisher's exact test. †Glomerular diseases

Table 3. Established causes of CKD in adults and elderly by residency.

	Residence					
	Rural		Urban		Total	
	No.	(%)	No.	(%)	No.	(%)
Unknown	14	(25.0)	11	(9.6)	25	(14.7)
Cardio-renal syndrome type I	1	(1.8)	3	(2.6)	4	(2.4)
Cardio-renal syndrome type II	3	(5.4)	1	(0.9)	4	(2.4)
Hypertension	7	(12.5)	21	(18.4)	28	(16.5)
Type II diabetes	11	(19.6)	26	(22.8)	37	(21.8)
Type I diabetes	1	(1.8)	6	(5.3)	7	(4.1)
Congenital bilateral vesicoureteric reflux nephropathy	0	(0.0)	2	(1.8)	2	(1.2)
Focal segmental glomerulosclerosis †	4	(7.1)	10	(8.8)	14	(8.2)
Minimal change disease†	1	(1.8)	0	(0.0)	1	(0.6)
IgA nephropathy †	1	(1.8)	4	(3.5)	5	(2.9)
Membranous nephropathy †	3	(5.4)	3	(2.6)	6	(3.5)
Membranous nephropathy+ focal segmental glomerulosclerosis †	0	(0.0)	3	(2.6)	3	(1.8)
Mesangioproliferative glomerulonephritis †	0	(0.0)	1	(0.9)	1	(0.6)
Polycystic kidney disease	3	(5.4)	10	(8.8)	13	(7.6)
Systemic lupus†	1	(1.8)	1	(0.9)	2	(1.2)
Prolonged use of NSAID	0	(0.0)	2	(1.8)	2	(1.2)
Unilateral renal artery stenosis	2	(3.6)	3	(2.6)	5	(2.9)
Bilateral renal artery stenosis	0	(0.0)	1	(0.9)	1	(0.6)
Liver cirrhosis	1	(1.8)	0	(0.0)	1	(0.6)
Gout	0	(0.0)	1	(0.9)	1	(0.6)
Bilateral obstructive uropathy by stones	0	(0.0)	2	(1.8)	2	(1.2)
Bilateral obstructive uropathy by CA prostate metastasized to the bladder	1	(1.8)	0	(0.0)	1	(0.6)
Acute kidney injury-intrinsic cause due to rhabdomyolysis	0	(0.0)	1	(0.9)	1	(0.6)
Acute kidney injury-prerenal cause due to bleeding	0	(0.0)	1	(0.9)	1	(0.6)
Bilateral obstructive uropathy by benign prostatic hypertrophy	1	(1.8)	0	(0.0)	1	(0.6)
IgA nephropathy + focal crescentic glomerulonephritis †	0	(0.0)	1	(0.9)	1	(0.6)
Bilateral obstructive uropathy by retroperitoneal fibrosis	1	(1.8)	0	(0.0)	1	(0.6)
Total	56	(100.)	114	(100.)	170	(100)

P = 0.219 (Calculated by Fisher's exact test). † Glomerular disease

Table 4. Progression of CKD by established causes of the disease and causes of advanced stages.

	Progression					
	No		Yes		Causes of advanced stages	
Causes of CKD	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**
Cardio-renal syndrome I	0	(0.0)	2	(100.0)	2	(2.4)
Cardio-renal syndrome II	0	(0.0)	1	(100.0)		
Hypertension	3	(25.)	9	(75.0)	10	(11.9)
Type II diabetes	1	(10.)	9	(90.0)	23	(27.4)
Type I diabetes	0	(0.0)	3	(100.0)	3	(3.6)
Congenital bilateral vesico ureteric reflux nephropathy	1	(14.)	6	(85.7)		
Congenital bilateral kidney dysplasia	0	(0.0)	1	(100.0)	1	(1.2)
Neurogenic bladder	0	(0.0)	2	(100.0		
Focal segmental glomerulosclerosis	0	(0.0)	10	(100.0)	1	(1.2)
Minimal change disease	1	(25.)	3	(75.0)		
IgA nephropathy	0	(0.0)	4	(100.0)	2	(2.4)
Membranous nephropathy	0	(0.0)	6	(100.0)		
Membranous nephropathy and focal segmental glomerulosclerosis	0	(0.0)	3	(100.0)		
Mesangioproliferative glomerulonephritis	0	(0.0)	1	(100.0)		
Polycystic kidney disease	2	(20.)	8	(80.0)	3	(3.6)
Prolonged use of NSAID	0	(0.0)	1	(100.0)	1	(1.2)
Unilateral renal artery stenosis	0	(0.0)	1	(100.0)	4	(4.8)
Cystinosis	0	(0.0)	2	(100.0		
Liver cirrhosis	0	(0.0)	1	(100.0)		
Obstructive uropathy by stones	0	(0.0)	1	(100.0)		
IgA nephropathy + focal crescentic GN	0	(0.0)	1	(100.0)		
Unknown					25	(29.8)
Systemic lupus erythromatosis					1	(1.2)
Bilateral renal artery stenosis					1	(1.2)
Gout					1	(1.2)
Acute kidney injury-postrenal due to bilateral obstructive uropathy by stones					1	(1.2)
Acute kidney injury-postrenal due to CA prostate metastasized to the bladder					1	(1.2)
Acute kidney injury-intrinsic cause due to rabdomyolysis					1	(1.2)
Acute kidney injury-prerenal cause due to bleeding					1	(1.2)
Acute kidney injury-postrenal due to bilateral obstructive uropathy by benign prostatic hypertrophy					1	(1.2)
Acute kidney injury-postrenal due to bilateral obstructive uropathy by retroperitoneal fibrosis					1	(1.2)
Total	8	(9.6)	75	(90.4)	84	(100.0)

***p = 0.935 (calculated by Fisher's exact test).**

Table 5. Risk factors of CKD progression.

	Progression						
	No		Yes		Total		
	No.	(%)	No.	(%)	No.	(%)	P
Gender							
Male	4	(8.3)	44	(91.7)	48	(100.0)	
Female	4	(11.4)	31	(88.6)	35	(100.0)	0.716*
HbA1c							
Controlled	2	(66.7)	1	(33.3)	3	(100.0)	
Uncontrolled	0	(0.0)	11	(100.0)	11	(100.0)	0.033*
SBP							
< 130	4	(57.0)	3	(43.0)	7	(100.0)	
≥ 130	1	(1.7)	57	(98.3)	58	(100.0)	<0.001*
DBP							
< 80	4	(21.0)	15	(79.0)	19	(100.0)	
≥ 80	1	(2.2)	45	(97.8)	46	(100.0)	0.024*
Family history of CKD							
No	8	(10.4)	69	(89.6)	77	(100.0)	
Yes	0	(0.0)	6	(100.0)	6	(100.0)	> 0.999*
Smoking							
No	6	(8.2)	67	(91.8)	73	(100.0)	
Yes	0	(0.0)	6	(100.0)	6	(100.0)	
Ex-smoker	2	(50.0)	2	(50.0)	4	(100.0)	0.078*
IHD							
No	0	(0.0)	3	(100.0)	3	(100.0)	
Yes	1	(9.1)	10	(90.9)	11	(100.0)	> 0.999*
CVA							
No	1	(9.1)	10	(90.9)	11	(100.0)	
Yes	0	(0.0)	3	(100.0)	3	(100.0)	> 0.999*
BMI							
Under-weight	0	(0.0)	1	(100.0)	1	(100.0)	
Normal	2	(9.5)	19	(90.5)	21	(100.0)	
Over-weight	3	(10.7)	25	(89.3)	28	(100.0)	
Obese	1	(16.7)	5	(83.3)	6	(100.0)	0.733*
Prolonged use of nephrotoxic drugs							
No	8	(10.7)	67	(89.3)	75	(100.0)	
Yes	0	(0.0)	8	(100.0)	8	(100.0)	> 0.999*

Table 5. Continue...

Single functioning kidney							
No	8	(9.9)	73	(90.1)	81	(100.0)	
Yes	0	(0.0)	2	(100.0)	2	(100.0)	> 0.999*
Nephrolithiasis							
No	8	(9.8)	74	(90.2)	82	(100.0)	
Yes	0	(0.0)	1	(100.0)	1	(100.0)	> 0.999*
Recurrent UTI							
No	8	(11.1)	64	(88.9)	72	(100.0)	
Yes	0	(0.0)	11	(100.0)	11	(100.0)	0.589*
Amount of protein urea by 24-hour urine collection or PCR							
< 1 g	2	(20.0)	8	(80.0)	10	(100.0)	
≥ 1 g	0	(0.0)	29	(100.0)	29	(100.0)	0.03*
Hb level							
Anemia	2	(3.8)	51	(96.2)	53	(100.0)	
Normal	3	(14.3)	18	(85.7)	21	(100.0)	0.135*
Uric acid							
Low	0	(0.0)	1	(100.0)	1	(100.0)	
Normal	1	(14.3)	6	(85.7)	7	(100.0)	
High	1	(6.7)	14	(93.3)	15	(100.0)	> 0.999*
Cholesterol							
Normal	2	(10.5)	17	(89.5)	19	(100.0)	
High	1	(5.9)	16	(94.1)	17	(100.0)	> 0.999*
Triglycerides							
Normal	1	(6.3)	15	(93.8)	16	(100.0)	
High	0	(0.0)	6	(100.0)	6	(100.0)	> 0.999*
LDL							
Normal	0	(0.0)	6	(100.0)	6	(100.0)	
High	0	(0.0	2	(100.0)	2	(100.0)	NA
HDL							
Low	0	(0.0)	9	(100.0)	9	(100.0)	NA
Phosphate							
Low	0	(0.0)	1	(100.0)	1	(100.0)	
Normal	0	(0.0)	5	(100.0)	5	(100.0)	
High	0	(0.0)	5	(100.0)	5	(100.0)	NA

***By Fisher's exact test.**

DISCUSSION

As mentioned, chronic kidney disease is very common, irreversible, progressive, and associated with higher cardiovascular risk. Therefore, many factors play a role in creating it. Since there is little information about chronic kidney disease in Suleimani, our study is one of the opportunities to investigate the characteristics of CKD patients in Sulaimani.

Based on the results, minimal change disease was the most common glomerular disease in children, the percentage of which was higher in rural than urban residents (37.5% vs. 21.4%, respectively); this can be due to poverty and living in crowded conditions so that environmental factors may be necessary for the development of nephrotic syndrome.

Congenital urological abnormalities, hereditary metabolic nephropathy of the neurogenic bladder caused by myelomeningocele, and diabetic nephropathy were other common causes, respectively. According to the results of Mortazavi F et al.'s study (2010), urological abnormalities were the most common cause of chronic kidney disease, with 36.5%. Also, obstructive uropathy, followed by acquired glomerular diseases, was recognized as the second most common cause. Moreover, focal segmental glomerulosclerosis was recognized as the first cause of glomerular diseases with 59% [13]. Also, based on the study of Safouh and Fazel et al. (2015), the most common cause of chronic kidney disease was obstructive uropathy (21.7%). Moreover, in the next ranks are unknown following causes 20.6%, primary glomerulonephritis (15.3%), reflux/urinary tract infections (14.6%), aplasia/hypoplasia (9.8%), and family/metabolic diseases (6.8%) were located [14].

The study by Ullah et al. (2015) revealed that the most common three causes of CKD in adults and the elderly were diabetic nephropathies (28%), glomerulonephritis (22%), and hypertension (14.6%), which is the same order as our study. Also, the unknown causes were in a significant percentage of patients (10.6%) but less than that recorded in our study [15]. Additionally, the study by Salman et al. (2015) showed that diabetic nephropathy was the leading cause of CKD (44.9%), followed by hypertension (24.2%) [16]. The point about high blood pressure in our study, which was ranked third, was that some of the cases were young and had high blood pressure. Many of them had uncontrolled blood pressure with the use of several drugs, but screening for the underlying cause was not done, and only tests were done to control it with drugs. Therefore, they were diagnosed with advanced chronic kidney disease.

Also, based on the results, it was found that approximately one-third of the cases with CKD of unknown cause were from rural areas with a lack of knowledge, poor screening for the highly risky people, especially at the periphery, and low economic status. Therefore, these cases can be involved in the results of our study.

Based on the study conducted by Amoako et al. (2014), the majority of the patients (85.8%) presented with advanced CKD (stages 4 and 5). This high percentage was attributed to the high unemployment rate, low detection and treatment of CKD risk factors like hypertension and diabetes mellitus, high cost of health services, and lack of regular CKD screening programs [17]. About 50% of all patients in our sample were diagnosed when they reached advanced stages (stage IV, V). Also, Kang et al. (2017) revealed that the percentage of advanced CKD (stages 4 and 5) was the highest in the diabetic nephropathy group [18]. The most common cause recorded in our study was diabetic nephropathy (31%), which is essential to note that diabetic nephropathy is usually silent until it reaches an obvious stage (stage IV).

In addition, a high percentage of patients who entered ESRD were hypertensive.

Many patients with the presumed diagnosis of hypertensive nephrosclerosis have undiagnosed ischemic nephropathy as the aetiology of their ESRD.

The clinician needs to identify ischemic renal disease because it is a potentially reversible cause of chronic renal failure in hypertensive patients. Therefore, correction of renal artery stenosis will lead to improvement of renal function or delay in progression to ESRD. Moreover, 29.8% of the recorded cases with advanced CKD accounted for unknown aetiology; therefore, as we mentioned before, CKD is a silent disease, and lack of knowledge and poor screening contributed to these results. Even those who were diagnosed at earlier stages of CKD, about 90% of them recorded progression later on to more advanced stages.

The contributed risk factors for the progression in our sample were uncontrolled diabetes (p-value = 0.033), proteinuria (≥1gm) (p-value=0.03) and uncontrolled blood pressure, whether systolic (p = < 0.001), and diastolic (p= 0.024).

One of the study's limitations was that many known cases of CKD were not included in the study due to forfeiture of their previous investigations due to fragmentation of the management and lack of documentation. In addition, regarding the measurement of BMI, in those with a history of prolonged oedema, we did not calculate the BMI, and some of the patients did not know their previous weight before the development of oedema. Also, patients who reached the hospital for the first time with advanced disease and complications underwent just the investigations that were available in the emergency room, which included k-level, complete blood count, ultrasound, and serum creatinine level. For some patients, we asked them to do investigations, but they refused (they are not cooperative usually because of the bad condition of the patient). In addition, a lipid profile is only done for a few patients because it needs fasting.

In conclusion, the most common recorded causes of chronic kidney disease among adults and elderly patients were diabetes mellitus, followed by glomerular diseases and hypertension. In contrast, among children, the most common causes were glomerular and congenital diseases. Uncontrolled diabetes, uncontrolled blood pressure and proteinuria (≥ 1gm/24 hrs) are the significant risk factors for the progression of CKD to more advanced stages in our study. Unfortunately, chronic kidney disease is underdiagnosed and undertreated in our locality. The poorest populations are at the highest risk, and awareness of the disorder remains low in the community and among many physicians. Screening and intervention can prevent chronic kidney disease, and implementation of management strategies can reduce the incidence of end-stage kidney disease.

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