**the Prevalence and Risk factors associated with end** -**stage renal disease (ESRD) patients in Sudan**

**Abstract**

**Background:** Chronic renal disease constitutes a serious worldwide clinical situation and considered to pose a real health problem, it causes considerable morbidity and mortality rates in developing countries. There were limited data about causes of ESRD in the Sudan.

**Aim:** This study aimed to determine the Risk factors or causes that associated with Renal Impairment in Sudanese patients with ESRD in Khartoum State, Sudan.

**Methods**: This is a cross sectional hospital based study.one hundred participants with ESRD, attending hemodialysis Renal Centers in Al-Amal and Omdurman Military Hospitals were enrolled in this study. Data was collected by using questionnaires; the medical files of each patient were reviewed to identify the cause of ESRD. All the participants were accepting and agree to participate before the start of the collection process. Informed consent was obtained from each participant. Data were analyzed using Statistical Package for Social Sciences program version 23.

**Results**: The study results showed that majority of participants 46.5% aged between (20 –34), followed by aged between (35-49) with percent 32.5%, age group (50-64) are 12%. (65-80) with percent 9%. The total percentages of male and female were 60.5%, and 39.5%, respectively. Employers 43%, non-employers 18%, students 15%, free business 13.5%, army 8.5%and retired 2%. Most important risk factor or causes of disease was hypertension HTN with percentage of 74%, followed diabetes mellitus DM with percentage of 14%. Poly cystic nephritis is also causing of the disease with percentage of 4%. HTN and DM, Nephritis has same percentage 3%. Minority of patients in this study were affected with Atrophy 2%. In patient aged from 35-49 years old the leading cause of ESRD was hypertension in Male (39.5%), in female (61.3%) with total of (48.6%) followed by diabetes mellitus in males (0.0%) and in females (50.0%) with total of (28.6%). In patient aged between 50 – 64years old the leading cause of ESRD was diabetes mellitus in males (50.0%) %), in females (37.5%) with total of (42.9%) followed by hypertension in males (16.3%), in females (22.6%) with total of (18.9%).

**Conclusion** **and recommendation**: The main risk factor or cause of ESRD in devolving chronic renal failure and subsequent ESRD in Sudanese patients hypertension followed by diabetes mellitus and they are common in economically productive age group that may represents major concern so good monitoring and treatment is the key of success in the prevention of ESRD.

**Keywords**, ESRD, hemodialyzed patients,. renal disease, urinary excretion

**1. Introduction**

“Kidneys are the vital organs that are involved in the urinary excretion of uremic toxins and the regulation of several body systems such as intra and extracellular volume status, acid-base status, calcium and phosphate metabolism or erythropoiesis. It also synthesizes the hormones that help to control blood pressure and keep the bones strong”(1). “Globally, chronic renal disorders constitute a serious medical problem. An important issue arising early during the treatment of renal failure is anemia. It has an important influence on the patient’s circulatory system, leading to heart hypertrophy, and as a consequence, to the Cardio-Renal Anemia Syndrome (CRAS)”(2, 3).

“End-stage renal disease (ESRD), defined as loss of kidney function such that life is unsustainable in the absence of renal replacement therapy (RRT), is an enormous public health challenge. RRT, provided in the form of a transplanted kidney or much more commonly, long-term dialysis, exacts an immense toll on the affected individual, the healthcare system, and society in general. Dialysis, as an “organ replacement therapy,” has been rightly hailed as one of the greatest advancements in the history of medicine1; however, it is expensive, burdensome, and far from an ideal solution to kidney failure”(4, 5)**.**

**2. Methodology**

##  This is cross sectional laboratory -based study took place in the Khartoum State in two hemodialysis Renal Centers in Al-Amal National and Omdurman Military Hospitals. A total of one hundred participants with ESRD, attending hemodialysis Renal Centers in Al-Amal and Omdurman Military Hospitals were enrolled in this study. Data was collected by using questionnaires; the medical files of each patient were reviewed to identify the cause of ESRD. All the participants were accepting and agree to participate before the start of the collection process. Informed consent was obtained from each participant. Data were analyzed using Statistical Package for Social Sciences program version 23.

**3. Results**

This study was conducted to determine the prevalence and risk factors among 200 patients with permanent renal impairment and they were on hemodialysis, Regarding the study participant’s sociodemographic characteristics, the study found the following findings:

**Age**: It ranged between 20-75 years old, 46 (23%) of the patients were age less than 25, 32 (16%) of study participants’ age was between 25-30 years. Mean age was 38.4 + 14.8 (Figure 1). **Gender:** Out of the two hundred people one hundred and twenty-one of participants (60.5%) were males while 79 (39.5%) were females. Male to female ratio was 3:2. (Figure 2). **Occupation**: The study found 68 (34%) of the participants were employers. It followed by 33 (16.5%) were housewives and 29 (14.5%) were students. (Table 4-1) Causes of renal impartment was found among 50% of study participants, HTN was the most frequent etiology of renal impartment, it found among 74% of diseased patients, it was followed by DM. DM presented among 14% of diseased patients. (Figure 4) and Relationship between causes and gender cross age of participants (table-5).

**Table (1): Frequency and percentage distribution of age**

|  |  |  |
| --- | --- | --- |
| **Age** | **Frequency** | **Percent** |
| 20 – 34 | 93 | 46.5 |
| 35 – 49 | 65 | 32.5 |
| 50 – 64 | 24 | 12 |
| 65 – 80 | 18 | 9 |
| Total | 200 | 100 |

**Figure (1): The sample distribution according to age**

**Table (2): clarified that total percentages of male and female who participated in this study are 60.5%, 39.5% respectively. Frequency and percentage distribution of gender**

|  |  |  |
| --- | --- | --- |
| **Gender** | **Frequency** | **Percent** |
| **Male** | 121 | 60.5 |
| **Female** | 79 | 39.5 |
| **Total** | 200 | 100.0 |

**Figure (2): The sample distribution according to gender**

Table (3): Frequency and percentage distribution of occupation

|  |
| --- |
|  |
| **Occupation** | **Frequency** | **Percent** |
| **Not employed** | 36 | 18.0 |
| **Student** | 30 | 15.0 |
| **Employed** | 86 | 43.0 |
| **Free business** | 27 | 13.5 |
| **Army** | 17 | 8.5 |
| **retired** | 4 | 2.0 |
| **Total** | 200 | 100.0 |

**Figure (3): The sample distribution according to occupation**

Table (4)**:**Frequency and percentage distribution of causes or risk factors

|  |  |  |
| --- | --- | --- |
| **Causes** | **Frequency** | **Percent** |
| **HTN** | 148 | 74 |
| **DM** | 28 | 14 |
| **HTN+DM** | 6 | 3 |
| **Poly-cystic kidney disease** | 8 | 4 |
| **chronic glomerulonephritis** | 6 | 3 |
| **Atrophy** | 4 | 2 |

**Figure (4): The sample distribution according to Causes of disease**

**Table (5): Relationship between causes and gender cross age of participants:**

|  |  |
| --- | --- |
| **With disease** | Total |
| **Risk factor** | **Age** | **Gender** |
| **Male** | **Female** |
| HTN | 20 – 34 | 7(16.3%) | 4(12.9%) | 11(14.9%) |
| 35 – 49 | 17(39.5%) | 19(61.3%) | 36(48.6%) |
| 50 – 64 | 7(16.3%) | 7(22.6%) | 14(18.9%) |
| 65 – 80 | 12(27.9%) | 1(3.2%) | 13(17.6%) |
| Total | 43(100%) | 31(100%) | 74(100%) |
| **DM** | 20 – 34 | 1(16.7%) | 1(12.5%) | 2(14.3%) |
| 35 – 49 | 0(0.0%) | 4(50.0%) | 4(28.6%) |
| 50 – 64 | 3(50.0%) | 3(37.5%) | 6(42.9%) |
| 65 – 80 | 2(33.3%) | 0(0.0%) | 2(14.3%) |
| Total | 6(100%) | 8(100%) | 14(100%) |
| **HTN+DM** | 50 – 64 | 1(50.0%) | 1(100%) | 2(66.7%) |
| 65 – 80 | 1(50.0%) | 0(0.0%) | 1(33.3%) |
| Total | 2(100%) | 1(100%) | 3(100%) |
| **Poly** | 35 – 49 | 2(66.7%) | 0(0.0%) | 2(50.0%) |
| 50 – 64 | 1(33.3%) | 0(0.0%) | 1(25.0%) |
| 65 – 80 | 0(0.0%) | 1(100%) | 1(25.0%) |
| Total | 3(100%) | 1(100%) | 4(100%) |
| **Nephritis** | 35 – 49 | 1(50.0%) | 1(100%) | 2(66.7%) |
| 65 – 80 | 1(50.0%) | 0(0.0%) | 1(33.3%) |
| Total | 2(100%) | 1(100%) | 3(100%) |
| **Atrophy** | 35 – 49 | 1(50.0%) | 0(0.0%) | 1(50.0%) |
| 50 – 64 | 1(50.0%) | 0(0.0%) | 1(50.0%) |
| Total | 2(100%) | 00.0% | 2(100%) |

**Discussion**

There are limited data on the causes of ESRD in Sudan, this study represents apart from few studies. The study results showed that majority of participants 46.5% aged between (20 –34), followed by aged between (35-49) with percent 32.5%, age group (50-64) are 12%. (65-80) with percent 9%.the that total percentages of male and female were 60.5%, 39.5%, respectively. “This indicates that ESRD in Sudan affects the economically productive age group, unlike the situation in many developed countries were the mean age of ESRD patients is generally over 60 years”(6,28).”In this study males constitute 60.5  % of ESRF patients receiving hemodialysis treatment; this is similar to many of other study conducted in Africa, in Ethiopia males constitute 61.5 % of ESRF patients receiving dialysis” (7), in Ivory Coast males constitute 61 % of (8).

Several studies reported an increase rate of unemployment among hemodialysis patients(8, 9). But in this study showed that 18 % of ESRD patients receiving hemodialysis treatment were unemployed; plus, about 15% of the participants are students and this reflect the financial burden on families of patients on hemodialysis.

“In this study we investigate the main causative factor that can lead to the developmentof ESRD in Sudan which is found to be hypertension HTN with percentage of 74%,as the same cause in many of African countries”(4, 5). “Which agree with other study that conducted in central Sudan in 2009 among 224 patients and found that hypertension is a leading cause of ESRF”(10). “Hypertension is considered to be a common health problem in Africa. 33 % of the general populations in Malawi were found to be hypertensive”(11). “Uganda the prevalence of hypertension was 22.1 % in men and 20.5 % in women”(12). In Nigeria, 20.8 % of general population found to be hypertensive (13).

“the result showed that diabetes mellitus was found to be the second leading cause of ESRD among patients with 50 – 64years old. A community based study conducted in Sudan in 1996 conducted among 1284 subjects found that prevalence of diabetes mellitus was 3.4 %”(14). “Other study conducted in Dongola in North Sudan found that prevalence of diabetes mellitus was 8.3 %” (15). Diabetes is the leading cause of ESRD in Latin America(16) and UK black patients(17). “In USA, the incidence of ESRD due to diabetes was 2.6 fold higher among blacks” (18).”Diabetes is a second leading cause of ESRF in many of SSA like in Nigeria” [29] (19)and in Senegal(20). “The prevalence of diabetic nephropathy in Africa is estimated to be 14–16 % in South Africa, 23.8 % in Zambia, 9 % in Sudan, and 6.1 % in Ethiopia” (21). Poly cystic nephritis is also causing of the disease with percentage of 4%. HTN and DM with 3%.

“chronic glomerulonephritis Nephritis has percentage of 3%. Agreed with previous two published studies conducted in Sudan on 1987 and 1989 found that chronic glomerulonephritis is one of the leading causes of ESRD”(22, 23), “however both studies were conducted in one center with small study samples. Our results are not agreed with many studies where the glomerulonephritis was found to be the second leading cause of ESRD. In Nigeria, 27.8 % of causes of ESRDare attributed to chronic glomerulonephritis” (1). “In Ghana, glomerulonephritis is a second leading cause of ESRD” (5). “In Senegal, 16 % of ESRF patients are due to chronic glomerulonephritis and consider being the second leading cause of ESRD following hypertension” (4). “The situation is different in South Africa where glomerulonephritis is a leading cause of ESRF”(24).

“The study showed that, 4.0 % of ESRD patients receiving dialysis are due to autosomal dominant polycystic kidney disease (ADPKD) and it remains the leading hereditary cause of ESRD in Sudan. Results obtained from European registries stated that ADPKD constitute about 9.8 % of ESRD patients receiving RRT”(25). “There were limited data about prevalence of ADPKD in Africa. The data is similar to other African studies. In Morocco, 6.5 % of patients on dialysis are due to ADPKD [42] similar to Libya which is 6.3 %” (26). “A hospital study conducted in Senegal found that prevalence of ADPKD was one in 250 patients following in Nephrology Department” (27).

**Conclusions**

ESRD in Sudan is a major health problem that affects the economically productive age group, the study showed the main risk factor or cause of ESRD in developing chronic renal failure and subsequent ESRD in Sudanese patients is hypertension followed by diabetes mellitus. Good monitoring, early diagnosis and treatment of such causes is the key factor in the successful prevention of these patients from progressing to ESRD.

**Ethical Approval:**

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

**Consent**

As per international standards or university standards, Participants’ written consent has been collected and preserved by the author(s).

Disclaimer (Artificial intelligence)

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Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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Details of the AI usage are given below:

1.

2.

3.

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