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Contribution to the Study of Diabetic Kidney Disease in a Sub-Saharan Environment: An Example of the Aristide Le Dantec University Hospital in Dakar

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Abstract

Introduction: Diabetic kidney disease (DKD) is a leading cause of chronic kidney disease and dialysis admission. Few studies are available in Sub-Saharan Africa. The objective of this work was to study the epidemiological, clinical, diagnostic and therapeutic characteristics of DKD in our context. **Patients and Methods:** We conducted an observational, exhaustive and retrospective study focusing on diabetic patients seen in consultation or hospitalized in the Nephrology Department of at the Aristide Le Dantec University Hospital in Dakar during a period of 5 years from January 1, 2017 to December 31, 2021. **Results:** Of 4735 patients seen during the study period, 491 had DKD, *i.e.* a hospital prevalence of 10.36%. The average age was 59.1 ± 11.4 years with a sex ratio of 0.95. Type 2 diabetes predominated with 93.4%. The average duration of diabetes was 11.5 ± 7.6 years. Diabetes was associated with high blood pressure in 78.81% of cases, dyslipidemia in 23.2% of cases, active smoking in 6.7% of cases and obesity in 1.6% of cases. Renal failure was the main reason for referral 72.3%. One hundred and forty-eight patients (30.1%) had uncontrolled diabetes. Macroalbuminuria was found in 64.8% and microalbuminuria in 18.7% of cases. One hundred and eighty-five patients (37.7%) were in Stage V of kidney disease and 137 patients were in Stage III (18.1% in Stage IIIb and 9.8% in Stage IIIa). Diabetic nephropathy was the main etiology at 61.30%. Nephropathy was mixed (diabetic and hypertensive) in 18.12 cases. Renin-angiotensin-aldosterone system (RAAS) blockers were prescribed in 83.5% of patients. **Conclusion:** The different etiologies encountered during the study show the diversity of diabetic kidney disease. Diabetic

nephropathy is not the only kidney damage that can occur in diabetics in our context.

Keywords

Diabetic Kidney Disease (DKD), Microalbuminuria, Diabetic Nephropathy

1. Introduction

Diabetic kidney disease (DKD) is the set of kidney lesions observed in diabetics [1]. These lesions can occur in all structures of the nephron: glomeruli, renal vessels, tubules and renal interstitium.

The risk factors for DKD are not very specific. Alongside essential chronic hyperglycemia, we find other vascular risk factors (tobacco, hypertension, dyslipidemia). It is necessary to add a family history of diabetes with nephropathy and factors, such as markers of inflammation, oxidative stress, advanced glycosylation products, hyperuricemia, cardiovascular abnormalities, and urinary tubular markers [2].

DKD remains a major public health issue; it represents 22% of the causes of Stage V chronic kidney disease, and its share has increased over the last decade [3]. The occurrence of kidney damage in diabetics is associated with an increased risk of cardiovascular morbidity and mortality, starting at the microalbuminuria stage [4].

The progression of diabetes in Senegal is much like elsewhere in the world. The first nationwide survey conducted in 2015 showed a prevalence of 3.4% in people aged 18 - 69 years and 7.9% in those over 45 years. The majority had type 2 diabetes [5]. These patients are often referred to nephrology at advanced stages of CKD (Stages 4 and 5) as evidenced by a previous study in our division of nephrology [6].

In Senegal, as in most countries in Sub-Saharan Africa, there have been publications on diabetic nephropathy. However, to our knowledge, DKD has not yet been studied in our country. This is why we set ourselves the objectives here of determining its prevalence and describing its clinical and paraclinical aspects.

2. Patients and Methods

This was an observational, exhaustive and retrospective study, based on patient files, over a period of 5 years, from January 1, 2017 to December 31, 2021. The study population consisted of diabetic patients received in consultation or hospitalized in the Nephrology Department at the Aristide Le Dantec University Hospital in Dakar during the study period.

We included diabetic patients with kidney disease referred or admitted to the Nephrology Department during the study period. Unusable files were excluded.

Data was collected on a pre-established and standardized survey form for all

medical records. From this sheet, we collected epidemiological, clinical, biological, and morphological data.

MRD was defined as any chronic renal damage (>3 months) occurring in a diabetic patient.

The data collected was entered using the Sphinx software serving as a database and the SPSS (Statistical Package for Social Sciences) software. The variables are compared using the KHI 2 or Fischer test depending on their applicability condition. The difference was statistically significant at a $p < 0.05$.

Local ethics committee gave its approval for the study.

3. Results

During the study period, 4735 patients were consulted, among whom 491 had diabetic kidney disease, representing a hospital prevalence of 10.36%. The average age was 59.1 ± 11.4 years with extremes of 25 and 90 years. The age group of 61 to 70 years was the most representative (Figure 1). The sex ratio was 0.95 with 51.3% female patients and 48.7% male. Type 2 diabetes was found in 459 patients (93.4%), type 1 diabetes in 32 patients (6.6%). The average duration of diabetes was 11.5 ± 7.6 years. Hypertension was present in 78.81% of patients. Other comorbidities and chronic complications of diabetes are shown in Table 1.

Renal insufficiency represented 72.3% of the reasons for consultation followed by renal oedematous syndrome (12.8%).

The main syndromes found at the clinic were: chronic glomerular nephropathy syndrome in 81.6%, uremia in 27.7%, and anemic syndrome (35.8%). Mean systolic blood pressure was 173.2 ± 21.1 mmHg with extremes of 130 - 270 mmHg. Mean diastolic blood pressure was 94.6 ± 13.9 mmHg with extremes of 57 - 140 mmHg.

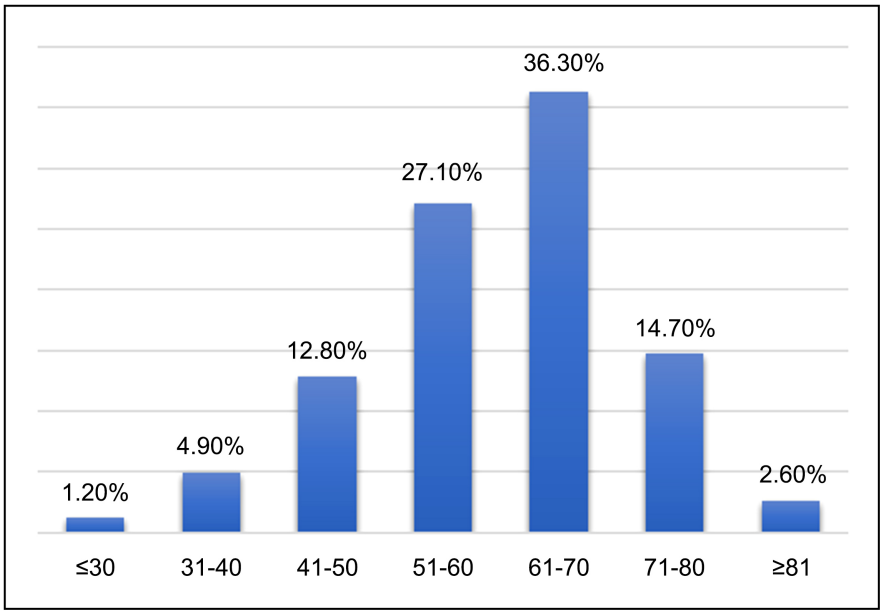

Figure 1. Distribution of patients by age.

Table 1. Epidemiological parameters, comorbidities, and diabetic complications of the study population.

Parameters	Results
Epidemiological parameters	
Mean age	59.1 ± 11.4 years
Sex-ratio (male/female)	0.95 (51.3%/48.7%)
Type 1 diabetes	6.6%
Type 2 diabetes	93.4%
Average duration of diabetes	11.5 ± 7.6 years
Comorbidities	
Hypertension	78.81%
Smoking	6.7%
Obesity	1.6%
Dyslipidemia	23.2%
Stroke	7.1%
Heart failure	19.6%
Gout	1.22%
Cancer	1.62%
Sickle cell disease	1.01%
Chronic complications of diabetes	
• **Diabetic microangiopathies**	
Diabetic retinopathy	59.87%
Diabetic neuropathy	7.94%
• **Diabetic microangiopathies**	
Peripheral arterial disease (PAD)	14.86%
Coronary heart disease	6.31%
Diabetes therapy on admission	
Insulin	40.32%
Oral antidiabetic drugs	32.99%
Diabetic diet alone	26.68%

Biologically, the average blood sugar level was 1.5 ± 0.8 g/l with extremes of 0.5 to 7.3 g/l with an average glycated hemoglobin of 8.0% ± 2.7%. The mean serum creatinine was 49.3 ± 52.7 mg/l with a mean GFR (according to CKD-EPI) of 28.7 ± 25.5 ml/min. Stage V of CKD was the most representative (**Figure 2**). Mean proteinuria was 2.1 ± 2.4 g/24h with ranges from 0.15 to 12.0 g/24h. Mean Calcemia and Phosphataemia were 87.2 ± 11.6 mg/l and 46.9 ± 23 mg/l respectively. The other biological parameters are shown in **Table 2**.

Table 2. Biological characteristics of the study population.

Parameters	Results
	Mean, SD or percentage, extremes
Blood glucose	1.5 ± 0.8 (0.5 - 7.3)
Glycated hemoglobin	8.0 ± 2.7 (3.5 - 14)
Blood urea nitrogen	1.2 ± 0.9 (0.15 - 8.64)
Serum creatinine	49.3 ± 52.7 (3.3 - 387)
eGFR	28.7 ± 25.5 (1 - 133)
Calcemia	87.2 ± 11.6 (30 - 109)
Phosphataemia	46.9 ± 23 (15.4 - 22.5)
Hemoglobin	9.7 ± 2.5 (3.6 - 16.4)
Total cholesterol	2.1 ± 0.7 (0.8 - 4.6)
LDL cholesterol	1.4 ± 0.6 (0.4 - 3.8)
HDL cholesterol	0.5 ± 0.2 (0.1 - 4.2)
Triglyceride	1.1 ± 0.6 (0.1 - 4.2)
Natremia	136.2 ± 6.6 (101 - 156)
Kalemia	4.7 ± 0.9 (1.8 - 7.8)
Chloremia	103.4 ± 7.6 (62 - 139)
Microalbuminuria	285.5 ± 732.4 (30 - 300)
Macroalbuminuria	2.1 ± 2.4 (0.3 - 12 g/24h)
Hematuria	5.1%
Leukocyturia	6.3%
Urinary infection	9.8%

Of all the DKDs, diabetic nephropathy was found in 301 patients (61.30%) followed by the mixed nephropathy in 89 patients (18.12%). The other attacks are represented in Table 3.

Therapeutically, renin-angiotensin-aldosterone system (RAAS) blockers were prescribed in 83.5% of patients. Insulin therapy was prescribed in 39.9% of cases. Concerning oral antidiabetics: metformin was prescribed in 23.8% of cases, sulphonylureas in 7.3% of cases, and DPP-4 inhibitors in 1.0% of cases.

At the reporting date, mortality was 4.3%. Admission to dialysis was noted in 13.2% of patients. The others are still followed in nephrology consultation.

Analytically, the presumptive diagnosis of diabetic nephropathy was statistically associated with the absence of haematuria ($p < 0.001$) and leukocyturia ($p < 0.001$) and the presence of nephrotic syndrome ($p < 0.003$) (Table 4).

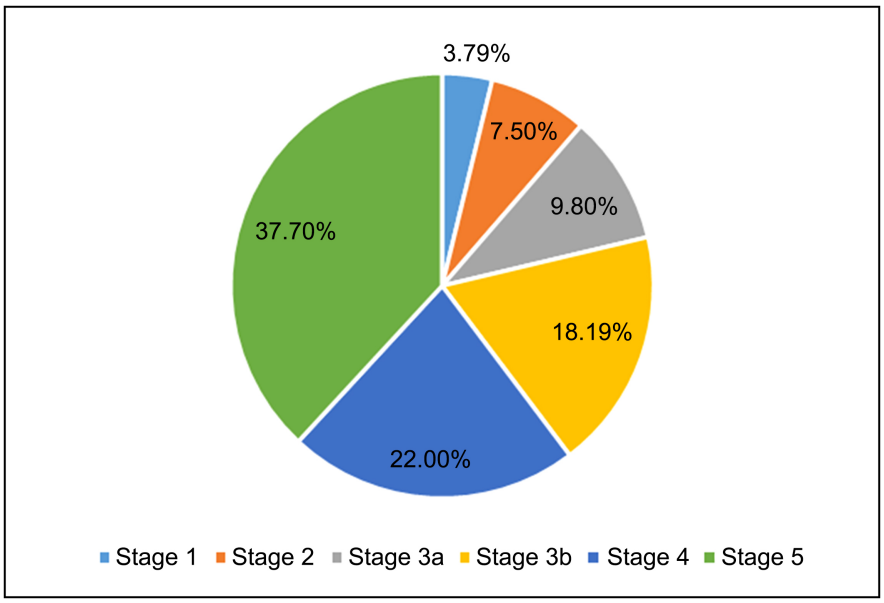

Figure 2. Distribution of patients according to stage of chronic kidney disease.

Table 3. Distribution of patients according to etiology found.

Renal damage		Number	Percentage (%)
Diabetic nephropathy		301	61.30
Mixed nephropathy		89	18.12
Atherosclerotic renal artery	Hypertensive nephropathy	61	12.42
	Renal artery stenosis	3	0.62
Tubulointerstitial nephritis	Pyelonephritis	31	6.31
	Drug toxicity	6	1.22
Total		491	100.0

Table 4. Association between clinico-biological variables and the diagnosis of diabetic nephropathy.

		OR (95% CI)	p
Age (years)		0.99 (0.97 - 1.01)	0.212
Sex	Women	Reference	0.685
	Men	1.08 (0.75 - 1.54)	
Type of diabetes	Type 1	Reference	0.930
	Type 2	1.61 (0.28 - 4.00)	
Duration of diabetes		1.01 (0.98 - 1.03)	0.646
Metabolic complications	No	Reference	0.063
	Yes	1.52 (0.98 - 2.36)	
Diabetic retinopathy	No	Reference	
	Yes		
High blood pressure	No	Reference	0.735
	Yes	0.93 (0.6 - 1.43)	
Hematuria	Yes	Reference	< 0.001
	No	1.98 (1.34 - 2.94)	
Leukocyturia	Yes	Reference	< 0.001
	No	1.98 (1.33 - 2.94)	
Nephrotic syndrome	No	Reference	0.003
	Yes	2.37 (1.3 - 4.32)	

4. Discussion

The prevalence of DKD followed the global epidemic of obesity and type 2 diabetes mellitus. No region seems to be spared from this scourge, including the Mediterranean region that was until now [7] [8] [9]. DKD is by far the leading cause of end-stage chronic renal failure leading to dialysis treatment. It represents almost 60% in the United States, almost 50% in Asia and almost 40% in Europe [10] [11] [12]. In our context, the prevalence is high (10.36%) but comes second after hypertension that remains the leading cause of CKD in Senegal [13].

In our series, the average duration of progression of diabetes was 11.5 ± 7.6 years reflecting the natural history of progression of diabetic nephropathy described in the literature. In our series, hypertension was noted in 78.81% of patients. These results are justified by the association of diabetes and hypertension, which both contribute to DKD [1] [14].

In our context, the main reasons for consultations were impaired renal func-

tion followed by macroalbuminuria. This demonstrates a late referral of diabetic patients to nephrology consultations in Sub-Saharan Africa, as evidenced by the study of Adebamowo *et al.* [15]. Hence, there is a need to establish multidisciplinary management strategies for diabetic patients in Sub-Saharan Africa to better prevent DKD.

The diagnosis was mainly made at Stage V (37.7% of patients) then at Stage III 27.9% and at Stage IV 22.0%. This result demonstrates the delay in diagnosing patients in our hospitals.

In our series, diabetic nephropathy represented the first attack (58.9%) followed by mixed nephropathy (diabetic and hypertensive) in 13.0% of cases. A third of type 2 diabetic patients with macroproteinuria have histological lesions that are not solely related to diabetic nephropathy [16]. Associated histological lesions are also possible, notably diabetic nephropathy and hypertensive nephropathy (nephroangiosclerosis) can coexist [16] [17] [18]. Only renal biopsy therefore makes it possible to correctly classify the histological involvement but the proportion of diabetics benefiting from a renal biopsy is low (<20%) while the clinical diagnosis of nephropathy varies depending on the type of diabetes.

Renin-Angiotensin-Aldosterone System Blockers were prescribed in 83.5% of patients in our cohort. We need to sensitise more our general practitioners aware of the usefulness of prescribing these molecules, especially at the onset of microalbuminuria and/or an association with hypertension.

Sodium-glucose cotransporter-2 (SGLT2) inhibitors or gliflozins occupy an increasingly important place in the treatment of patients with type 2 diabetes. This is particularly the case in patients with proven cardiovascular disease, heart failure, chronic kidney disease, or in patients with a combination of risk factors exposing them to such complications [19].

SGLT2 inhibitors provided evidence of nephroprotection, demonstrated by a reduction in albuminuria, a lesser decline in long-term renal function and a reduction in progression to ESRD or death from renal causes. This nephrological benefit adds to the CV protection already described, including a reduction in the incidence of major CV events and, above all, hospitalizations for heart failure. The favourable renal effects are consistent in the different subgroups studied, separated by the presence or absence of heart failure at inclusion, by the level of GFR, and by the rate of albuminuria. These remarkably consistent results have given SGLT2 inhibitors pride of place in the latest international recommendations in diabetes, cardiology, and nephrology [20]. As we complete this article, SGLT2 inhibitors are not currently available in Senegal.

5. Conclusion

In our context, DKD is a public health problem. It remains the 2nd cause of CKD after hypertension. It is dominated by diabetic nephropathy followed by mixed nephropathy (diabetic and hypertensive). Early detection and, above all, multidisciplinary collaboration between nephrologists, diabetologists and general prac-

titioners will reduce its high prevalence in our country.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Chen, Y., Lee, K., Ni, Z. and He, J.C. (2020) Diabetic Kidney Disease: Challenges, Advances, and Opportunities. *Kidney Disease*, **6**, 215-225. https://doi.org/10.1159/000506634

[2] Espinel, E., Agraz, I., Ibernon, M., *et al.* (2015) Renal Biopsy in Type 2 Diabetic Patients. *Journal of Clinical Medicine*, **4**, 998-1009. https://doi.org/10.3390/jcm4050998

[3] Rezaianzadeh, A., Namayandeh, S.M. and Sadr, S.M. (2012) National Cholesterol Education Program Adult Treatment Panel III versus International Diabetic Federation Definition of Metabolic Syndrome, Which One Is Associated with Diabetes Mellitus and Coronary Artery Disease? *International Journal of Preventive Medicine*, **3**, 552-558.

[4] Gariani, K., De Seigneux, S., Martin, P.Y., Pechère-Bertschi, A. and Philippe, J. (2012) Néphropathie diabétique. *Revue Médicale Suisse*, **8**, 473-479.

[5] World Health Organization (WHO) (2021) On the Frontlines of Diabetes Fight in Senegal. https://www.afro.who.int/news/frontlines-diabetes-fight-senegal

[6] Ould Isselmoi, E.B., Abdou, N., Abdoulaye, L., *et al.* (2010) Aspect épidémiologique, et diagnostique de la néphropathies chez le diabétique: Étude rétrospective. *Diabetes & Metabolism*, **36**, A48. https://doi.org/10.1016/S1262-3636(10)70183-X

[7] Wild, S., Roglic, G., Green, A., *et al.* (2004) Global Prevalence of Diabetes: Estimates for the Year 2000 and Projections for 2030. *Diabetes Care*, **27**, 1047-1053. https://doi.org/10.2337/diacare.27.5.1047

[8] Bailey, R.A., Wang, Y., Zhu, V. and Rupnow, M.F. (2014) Chronic Kidney Disease in US Adults with Type 2 Diabetes: An Updated National Estimate of Prevalence Based on Kidney Disease: Improving Global Outcomes (KDIGO) Staging. *BMC Research Notes*, **7**, Article No. 415. https://doi.org/10.1186/1756-0500-7-415

[9] United States Renal Data System (USRDS) (2017) International Comparisons. https://www.usrds.org/2017/view/v2_11.aspx

[10] Boright, A.P., Paterson, A.D., Mirea, L., *et al.* (2005) Genetic Variation at the ACE Gene Is Associated with Persistent Microalbuminuria and Severe Nephropathy in Type 1 Diabetes: The DCCT/EDIC Genetic Study. *Diabetes*, **54**, 1238-1244. https://doi.org/10.2337/diabetes.54.4.1238

[11] Marre, M., Jeunemaitre, X., Gallois, Y., *et al.* (1997) Contribution of Genetic Polymorphism in the Renin-Angiotensin System to the Development of Renal Complications in Insulin-Dependent Diabetes. *Journal of Clinical Investigation*, **99**, 1585-1595. https://doi.org/10.1172/JCI119321

[12] Marre, M., Bouhanick, B. and Berrut G. (1994) Microalbuminuria. *Current Opinion in Nephrology and Hypertension*, **3**, 558-563. https://doi.org/10.1097/00041552-199409000-00015

[13] Lemrabott, A., Faye, M., Khadra, H., Cissé, M.M., Fall, K., Mbengue, M., Keita, N., Diagne, S., Diouf, B. and Ka, E.F.K. (2018) Néphroangiosclérose bénigne au CHU A. Le Dantec de Dakar: Aspects épidémiologique, clinique, paraclinique, thérapeu-

tique et évolutif. *Néphrologie & Thérapeutique*, **14**, 384. https://doi.org/10.1016/j.nephro.2018.07.302

[14] Alicic, R.Z., Rooney, M.T. and Tuttle, K.R. (2017) Diabetic Kidney Disease: Challenges, Progress, and Possibilities. *Clinical Journal of the American Society of Nephrology*, **12**, 2032-2045. https://doi.org/10.2215/CJN.11491116

[15] Adebamowo, S.N., Adeyemo, A.A., Tekola-Ayele, F., Doumatey, A.P., Bentley, A.R., Chen, G., *et al.* (2016) Impact of Type 2 Diabetes on Impaired Kidney Function in Sub-Saharan African Populations. *Frontiers in Endocrinology*, **7**, Article 204268. https://doi.org/10.3389/fendo.2016.00050

[16] Fioretto, P., Caramori, M.L. and Mauer, M. (2007) The Kidney in Diabetes: Dynamic Pathways of Injury and Repair. The Camillo Golgi Lecture 2007. *Diabetologia*, **51**, 1347-1355. https://doi.org/10.1007/s00125-008-1051-7

[17] Mazzucco, G., Bertani, T., Fortunato, M., *et al.* (2002) Different Patterns of Renal Damage in Type 2 Diabetes Mellitus: A Multicentric Study on 393 Biopsies. *American Journal of Kidney Diseases*, **39**, 713-720. https://doi.org/10.1053/ajkd.2002.31988

[18] Cohen Tervaert, T.W., Mooyaart, A.L., Amann, K., *et al.* (2010) Pathologic Classification of Diabetic Nephropathy. *Journal of the American Society of Nephrology*, **21**, 556-563. https://doi.org/10.1681/ASN.2010010010

[19] Scheen, A.J. (2020) Sodium-Glucose Co-Transporter Type 2 Inhibitors for the Treatment of Type 2 Diabetes Mellitus. *Nature Reviews Endocrinology*, **16**, 556-577. https://doi.org/10.1038/s41574-020-0392-2

[20] Scheen, A.J. and Delanaye, P. (2021) Inhibiteurs des SGLT2: Focus sur le rein et la néphroprotection. *Revue Médicale Suisse*, **17**, 1397-1403. https://doi.org/10.53738/REVMED.2021.17.747.1397