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Renal dysfunction and associated factors among PLHIV,undergoingantiretroviraltreatmentattheMakokouOutpatientTreatmentCenter(MKK-OTC),Ogooué-Ivindo, North-East Gabon.

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ABSTRACT :

Nowadays, kidney dysfunction is a real public health problem. Unfortunately, information ontheprevalenceofthisdiseaseamongpeoplelivingwithHIVisnon-existent.Thisworkstudiesthe prevalence of renal dysfunction and associated risk factors among people living withHIV/AIDS,underantiretroviraltreatment,attheoutpatienttreatmentcenterofMakokou(CTA-MKK);intheNorth-EastofGabon.

Thisiscross-sectionalanddescriptivestudyanalysisofpatientrecordconductedfromJanuaryto December 2022.It included all PLWHIV undergoing antiretroviral treatment and followedat the Makokou outpatient treatment center. Among these patients, at least one marker of renalimpairment (elevation of plasma creatinine, deterioration of the estimated glomerular filtrationrate (eGFR)) was diagnosed. The parameters analyzed were sociodemographic, clinical, andparaclinical.Statistical analyseswereperformedatthe95%level,andtheresultsweresignificantatp≤0.05.

A total of 356 HIV-1 positive individuals participated in this study. With a mean age of 50.21years,18%ofHIV-positiveindividualswerediagnosedwithrenaldysfunction(95%CI:[0.14-0.22]). Univariate analyses and adjustment of the prevalence of renal dysfunction according tosociodemographic,clinicalandpara-clinicalcharacteristics,amongHIV-infectedpersonsattheMakokouCTA,indicatedthatfemalegender(adjustedOR=1.45;95%CI:[1.13;1.85] p=0.003),agerange≥61years(adjustedOR=0.46;95%CI[0.29;0.87]p=0.016),duration onATRtreatment(adjustedOR=0.023;95%CI:[0.004;0.126]p=0.000),overweight (adjustedOR=85.9;95%CI:[1.416;5214]p=0.034),viralload(adjustedOR=0.0038;95% CI[0.003;0.64]9=0.024),andsevereimmunedeficiency(adjustedOR=122.5;95%CI:[1.18 ;7584]p=0.022),wereidentifiedaspotentialsignificantriskfactorsforrenaldysfunctioninthe presentstudy. Inordertopredictandmonitordiseaseseverityandriskstratificationamong PLWHIV,studiesonthe prevalence,molecularandclinicalepidemiologyofrenaldysfunctionare needed.

Keywords:Renaldysfunction,PLWHIV,Outpatienttreatmentcenter;Makokou;Gabon.

INTRODUCTION

Increasinglyobservedinhistologicaldiagnoses,renaldysfunctionevolvessilentlyandasymptomati cally in populations. Thus, a delay or lack of treatment linked to the lack oftechnical andhuman resourcesin remote areas of large urban centres may contribute toincreasing the frequency of this condition [1]. The absence of specialists in these regions and,above all, the precariousness of the populations, may justify the difficulty or absence oftreatment [2]. In an immunocompromised environment due to HIV, renal damage is veryrecurrent andmay have differentanatomopathological or clinical forms [3]. The variousassociated factors revealed are age, high viral load, a lowered CD4 count, co-infection withHCV, being black, hypertension and diabetes [2]. By constituting a morbidity/mortality factorthat requires special precautions that are not well known to practitioners caring for thesepatients, HIV has a direct impact on the kidney and is responsible for lesions such as HIVAssociatedNephropathy(HIVAN), anHIV-inducednephropathy[3].Regardlessoftreatment,which may be toxic, HIV alone is a risk factor for kidney damage in both young children andadults, increasing the risk of kidney damage [4]. The calculation of the estimated glomerularfiltration rate (eGFR) may pose a problem of adaptation depending on the population studied[5]. For example, a highly malnourished population with limited immunosuppression andaccesstobiologicaltestsmayshowasharpdeteriorationinestimatedglomerular filtrationrate(eGFR) upon initiation of treatment with tenofovir disoproxil fumarate (TDF), making thismolecule a risk factor [6]. In some parts of Africa, the prevalence of renal dysfunction rangesfrom 8.5% to 37% [7]. According to some studies, Africa is the region of the world mostaffected by HIV, and being black (whether African or African-American) is an additional risk[8]. Designed to neutralise HIV replication, some antiretroviral treatments are nephrotoxic andcontribute to amplify this effect if not followed up [3]. Given that the diagnosis of renalimpairment consists first of all of the assessment of creatinemia by the Jaffé method, followedby the calculation of eGFR, proteinuria and an ultrasound scan of the kidney, and despite astudy reporting a prevalence of 14.1%, defined by an estimated glomerular filtration rate(eGFR) of less than 60 mL/min/1.73m² in Congo Brazzaville [9], little or no data exist on theprevalence of renal dysfunction in many rural or semi-rural areas in sub-Saharan Africa, [10]notablyGabon.Inthesemi-ruralandruralareasofthiscountry,thelackofmeansandqualifiedpersonnel in the health structures do not always guarantee the respect of the steps required forthe complete diagnosis of renal dysfunction. It is in this context that this study aims to raiseawarenessoftheseriousnessofthisburdenthatcanleadto acuterenalfailure,byassessingthe

prevalenceofrenaldysfunctionandassociatedriskfactorsamongpeoplelivingwithHIV/AIDS(PLWHIV)and undergoingantiretroviraltreatment,inMakokouintheNorth-EastofGabon.

II. PATIENTSANDMATERIALS

II.1 Typeandsiteofthestudy

This is a cross-sectional and descriptive study, based on a retrospective analysis of the files ofpatientsfollowedattheoutpatientHIV/AIDStheMakokouOutpatientTreatmentCentre(CTA-MKK), from January to December 2022. The study population was composed of adults livingwithHIVandunderantiretroviraltreatmentforoneyear.

II.2 Inclusionandexclusioncriteria

The study included all HIV-positive patients undergoing antiretroviral treatment, followed upontheirresultstodate,attheMakokouOutpatientTreatmentCentre(CTA-MKK).Allpatientswho were lost to follow-up and those whose medical records could not be used, i.e. thebiological or socio-economic and demographic data required for the study were missing, wereexcludedfromthestudy

II.3 Datacollectionfromthemedicalrecord ofHIVpatientsinthe study

Fromthepatients'medicalrecordsandstandardisedsurveyforms,socio-economicdatasuchasage, sex, education level, marital status, occupation and place of residence were collected. Tocalculate BMI, anthropometric data such as height and weight were measured. In addition, thetypesofcombinationtherapyused,thedurationofantiretroviraltherapy,andcreatinineresultsfortheestimationofGlomerularFiltrationRate(GFR)werecollected.Asnoformulahasbeenvalidated in the sub-Saharan African population, the formula used in this study was the CKD-EPI formula recommended by the HAS (French Health Authority), for the diagnosis andmonitoringofrenaldiseases. Theuseofthis formula, whichonlyrequiresthecreatininevalue,was ideal because some patients had a body mass deficit. In this study proteinuria was not ornot assessed due to lack of data for some patients. Clinical data such as viral load, CD4 Tcellcount,bloodglucose andbloodpressure wererecorded.

Operationalcasedefinitions

Renal dysfunction (RD) or renal disease was considered to be a confirmed drop in eGFR to <60 mL/min/1.73 m 2, calculated from the CKD-EPI formula which requires two or moreconsecutiveeGFRresults,>90daysapart.Iftherewereмultipleegfr<60mL/min/1.73m^2,thetotaltimebetweenthefirstandlastmusthaveexceeded90days[12].Thetimetorenal

dysfunction was calculated based on the date of the second eGFR value < 60 mL/min/1.73 m^2.We usedtheKDIGOgrade classificationofCKD.[11]

Hypertension (HTA): As done elsewhere, hypertension was defined on the basis of thediagnosisofhypertensionora bloodpressureof140/90 mmHg orhigherontworeadingstakenwithinanintervalofatleast5minutes[13].

Bodymassindex(BMI):wasconsiderednormalforavaluebetween18.5and24.9kg/m².Theindividualwasleanfora BMI<18.5kg/m²;overweightiftheBMIvariedbetween25and 29.9kg/m² andobeseiftheBMI ≥30kg/m².[12]

Immune deficiency :was severe for a CD4 count < 200 cells/µL, moderate for a CD4 countbetween200and 499cells/µL3 andgoodimmunityforaCD4 count ≥500cells/µL[14]

Viralload: Thiswasmeasuredagainstcentrallaboratorytests(referencetest)[15].

Type 2 diabetes: As done elsewhere diabetes was defined by the presence of a fasting plasmaglucose(FPG)levelequaltoorgreaterthan7.0mmol/Lorarandomplasmaglucoselevelequaltoorgreaterthan11.1 mmol/Linapatientwithclassic symptomsofhyperglycaemia [16].

II.4. Dataprocessing

The collected data were entered into a Microsoft Excel spreadsheet, cleaned and then analysedwithRsoftwareversion3.6.1.Pearson'schi-square,Oddsratios,and95%confidenceintervalswere used tofind correlations between riskfactors and renal dysfunction. p-values weredetermined andconsideredsignificantwhentheywerelessthanorequalto0.05

II.5. Ethicalconsiderations.

Ethical authorization for data collection in this study was obtained through an administrativeagreement with the Director of the Makokou HIV/AIDS Outpatient Treatment Centre (CTA-MKK),andstrict respectfortheanonymityofthefileswasobserved.Allinformationobtainedin this study was keptconfidential and only those involvedin the study hadaccess, noidentifiable data was collected from participants and each was given a unique identificationnumber.

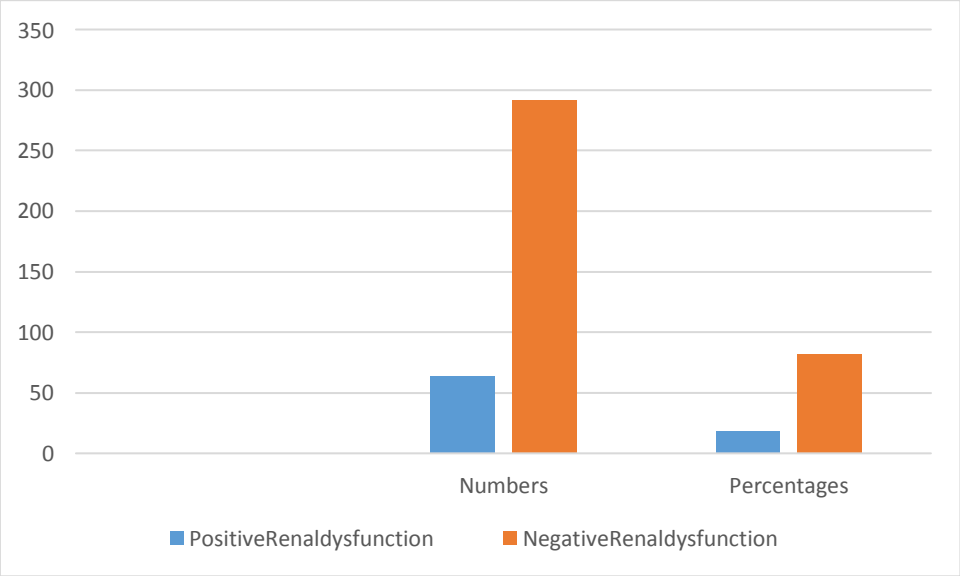
III. RESULTS

3.1. Prevalenceofrenaldysfunctioninthestudypopulation(N= 356).

In the present study, a total of 356 people living mainly with HIV type 1 participated in thestudy.Withan averageageof50.21years,womenpredominated overmen,givingasex ratio

(M/F)of0.38.Theprevalenceofrenaldysfunctionwas18%(95%CI:[0.14-0.22]),(n=64),comparedto82%(n=292)whowereHIV negative. Figure1.

Figure1:Prevalence ofrenaldysfunctioninthestudypopulation(N=356).



3.2. Univariate analysis of the prevalence of renal dysfunction among the PLWHA in thestudyaccordingtosociodemographic characteristics(N =356).

TheresultsobtainedfromthisanalysisindicatethatamongpeoplelivingwithHIV/AIDS in the Makokou CTA, the female sex (OR = 2.33; 95% CI: [1.13; 4.78]), thosebelongingtotheagegroupsof41-60years(OR=0.3;95%CI:[0.13;0.68]),and≥61years (OR=2.73;95%CI[1.49;4.99],theunemployed(OR=4.27;95%CI:[2.19;8.33]),single (OR=1.83;95%CI:[1.01;3.31])orcohabiting(OR=1.98;95%CI[1.03;3.81]),thosewith bothprimaryeducation(OR=2.73;95%CI:[2.64;2.82])andsecondarylevel(OR=0.36; 95% CI: {0.28;0.45]),had ahigher risk ofrenaldysfunction(Table1).

Table 1: Univariate analysis of the prevalence of renal dysfunction among PLHIV accordingtosocio-demographiccharacteristics.

Variables	Numbers(%)	PrévalenceofRenal Dysfunctionrénal(RD)		CrudeOR[IC 95%]	P-value
		PositiveRD (%)	NégativeRD (%)		
Gender					
Male	98(27.53)	10(10.20)	88(89.8)	Reference	
Female	258 (72.47)	54(20.93)	204(97.07)	2.33 [1.13;4.78]	0.018*

Age(years)					
19-40	196 (55.06)	35(17.86)	161(82.14)	Reference	
41-60	91(25.56)	7(7.69)	84(92.31)	0.3 [0.13;0.68]	0.015*
≥61	69(19;38)	22(31.88)	47(68.12)	2.73 [1.49;4.99],	0.000*
Maritalstatus					
Married	51(14.33)	0 (0)	51(100)	Reference	
Single	216 (60.67)	46(21.30)	170(78.7)	1.83 [1.01;3.31]	0.04*
Cohabiting	58(16.3)	16(27.59)	42(72.41)	1.98 [1.03;3.81]	0.034*
Widowed	31(8.7	2(6.45)	29(93.55)	0.29 [0.07;1.25]	0.080
Employmentstatus					
Employed	157(44.1)	12(14.01)	145(85.99)	Reference	
Unemployed	199(55.9)	52(26.13)	147(73.87)	4.27 [2.19;8.33]	<0.0001*
Educationlevel					
Illiterate	2(0.6)	0(0.0)	2(0.6)	Reference	
Primary	162(45.5)	42(25.93)	120(74.07)	2.73 [2.64;2.82]	0.0003*
Secondary	181(50.8)	181(50.8)	161(88.95)	0.36 [0.28;0.45]	0.0005*
University	11(3.1)	2(18.18)	9(81.82	1.01 [0.76;1.26]	0.98
Residence					
Ogooué-Ivindo	331 (90,45)	60(18.63	271(81.37)	Reference	
Otherplaces	25(9,55	4(11.76)	21(88.24)	0.86 [0.28;2.6]	0.78

OR=oddsratio;CI=confidenceinterval;*=significant test

3.3. Univariate analysis of the prevalence of renal dysfunction (RD) amongPLWHA in the study according to clinical and para-clinical characteristics (N =356).

Here, the results indicated that, people living with HIV/AIDS in the Makokou CTA, whosedurationofantiviraltreatmentvariedbetween6and10years(OR=5.04;95%CI[2.85;8.91] :] p= 0.001*) or ≥ 11 years (OR =0.32; 95% CI : [0.16 ; 0.65] p= 0.0011*), those with a BMIofbetween25and29.9kg/m²), i.e.,overweight(OR=0.23;95%CI:[0.05;0.98]p=0.030*),diabetics (OR = 0.11; 95% CI : [0.01 ; 0.82] p = 0.007*), whose HIV-1 viral load was ≥ 100000cop/ml)(OR=2.2;95%CI:[1.26;3.83]p=0.004*),whoseCD4+Tcellcount(cells/µL)was < 200/mm3 (OR = 2. 06; 95% CI: [1.13; 3.74] p = 0.001*), hypertensive patients (OR =0.11; 95% CI: [0.06 ;0.2] p < 0.001*), or those using antiretroviral combination therapies suchas: TDF / 3TC / EFV (tenofovir disoproxil fumarate / lamivudine / elvitégravir) (OR = 0.15;95% CI: [0.05; 0.49] p= 0.0003*), TDF/3TC/DTG (tenofovir disoproxil fumarate/lamivudine/dolutegravir)(OR=12.38;95%CI:[4.38;34.96]p<0.001*),andfinallyTDF / FTC / EFV tenofovir disoproxil fumarate / emtricitabine / elviravir) (OR = 0.14; 95%CI:[0.02;1.05]p=0.025*),hadahigherriskofrenaldysfunction.Table 2.

Table 2: Univariate analysis of the prevalence of renal dysfunctionamong HIV-infectedindividualsaccordingtoclinicalcharacteristics

Variables	Numbers(%)	PrévalenceofRenal dysfunction(RD)		CrudeOR[IC 95%]	P-value
		PositiveRD (%)	NegativeRD (%)		
DurationonART(years)					
≤ 5	131(36.8)	15(11.45)	116(88.55)	Reference	
6-10	108 (30.33)	39(36.11)	69(63.89)	5.04 [2.85;8.91]	<0.001*
≥ 11	117 (32.87)	10(8.55)	107(91.45)	0.32 [0.16;0.65]	0.0011*
BMI(BodyMassIndex)					
Normal(BMI =18.5and24.9 kg/m².)	206 (57.87)	39(8.93)	167(81.07)	Reference	
Lean (BMI<18.5 kg/m²)	61(17.13)	14(22.95)	47(77.05)	1.46 [0.75;2.85]	0.27
Overweight (BMI=25 and 29.9kg/m²)	38(10.67)	2(5.26)	36(94.74)	0.23 [0.05;0.98]	0.030*

Obese(BMI≥ 30kg/m².)	51(14.33)	9(17.65)	42(82.35)	0.97 [0.45;2.11]	0.94
Bloodpressure					
NormalBP	270 (75.84)	47(17.40)	69(82.6)	Reference	
Hypertensive	86(24.16)	17(17.77)	223(82.23)	0.11 [0.06;0.2]	<0.001*
Diabetic	61(10.96)	1(2.56)	38(97.44)	0.11 [0.01;0.82]	0.007*
Viralload HIV-1 (≥100 000 cop/ml)	160 (44.94)	39(24.36)	121(75,64) 121(75.64)	2.2 [1.26;3.83]	0,004*
CD4+T cellcount(cells /µl) <200/mm^3	77(21.63) 61(17.13)	21(27.27) 61(17.13)	56(73.761 (17.13)3)	2.06 [1.13;3.74]	0.01*
Combinationtherapiesused					
TDF / 3TC / ATZr	17(4.78)	0(0)	17(100)	Reference	
TDF / 3TC / EFV	75(21.07)	3(4)	72(96)	0.15 [0.05;0.49]	0.0003*
TDF / 3TC / DTG	220 (61.80)	60(27.27)	160(72.73)	12.38 [4.38;34.96]]	<0.001*
TDF / FTC / EFV	31(8.70)	1(3.23)	30(96.77)	0.14 [0.02;1.05]	0.025*
ABC/3TC/ ATZr	13(0.27)	0(0)	13 (100)	--	-

OR=oddsratio;CI=confidenceinterval;*=significant test

3.4. Multivariatelogisticregressionanalysisoftheprevalenceofrenaldysfunction amongthe study population according to socio-demographic and clinical characteristics (N =356).

Finally,theresultofthemultivariatelogisticregressionanalysisshowedthatfemalePLHIV(adjustedOR=1.45;95%CI:[1.13-1.85]p= 0.003),withan age≥61years(adjustedOR= 0.46;95%CI:[0.29-0.87]p=0.016),withdurationofantiretroviraltreatment≥11years (adjustedOR=0.023;95%CI:[0.0004-0.126]p=0.000),aBMIbetween25and29.9kg/m²) reflectingoverweight(adjustedOR=85.9;95%CI:[1.416;5214.]p=0.034),aviralload≥ 100000cop/ml(adjustedOR=0.038;95%CI:[0.03-0.024]p=0.000),severeimmune

deficiency (adjusted OR = 122.5; 95% CI: [198; 7584] p= 0.022), had a very high risk of renaldysfunction(table3).

Table3: Multi-variateanalysisoftheprevalenceofrenaldysfunctionamong HIV-positiveindividualsaccording tosocio-demographic andclinicalcharacteristics.

Variables	**Numbers(%)**	**PrévalenceofRenaldysfunction(RD)**		**AjustedOR[IC 95%]**	**P-value**
		PositiveRD(%)	**NegativeRD(%)**		
Gender					
Male	98(27.53)	10(10.20)	88(89.8)	Reference	
Female	258 (72.47)	54(20.93)	204 (97.07)	1.45 [1.13;1.85]	**0.003***
Age(years)					
19-40	91(25.56)	7(7.69)	84(92.31)	Reference	
41-60	196 (55.06)	35(17.86)	161 (82.14)	-	--
≥61	69(19;38)	22(31.88)	47(68.12)	0.46[.0.29;.0.87]	**0.016***
Maritalstatus					
Married	51(14.33)	0 (0)	51(100)	-	-
Single	216 (60.67)	46(21.30)	170(78.7)	-	-
Cohabiting	58(16.3)	16(27.59)	42(72.41)		
Widowed	31(8.71)	2(6.45)	29(93.55)	-	-
Employmentstatus					
Unemployed	199(55.9)	52(26.13)	147 (73.87)	-	-
Employed	157(44.1)	12(14.01)	145 (85.99)	-	-
Educationlevel					
Illiterate	2(0.6)	0(0.0)	2(0.6)	-	-
Primary	162(45.5)	42(25.93)	120 (74.07)	-	-
Secondary	181(50.8)	181(50.8)	161 (88.95)	-	-
University	11(3.1)	2(18.18)	9(81.82	-	
Residence					
Ogooué-Ivindo	331 (90,45)	60(18.63	271(81.37)	0.909 [0.095;8.1]	0.99
Otherplaces	25(9,55	4(11.76)	21(88.24)	Reference	
DurationonART(years)					

≤5years	131(36.8)	15(11.45)	69(81.48)	-		
6 à10 years	108 (30.33)	39(18.52)	69(81.48)	0.310 [0.089;1.970]		0.21
≥11years	117(32.87)	10(9.35)	107 (90.65)	0.023 [0.004;0.126]		0.000*
BMI(BodyMassIndex)						
Normal(BMI=18.5 and 24.9kg/ m².)	206 (57.87)	39(18.93)	167 (81.07)	Reference		
Lean(BMI <18.5 kg/m²)	61(17.13)	14(22.95)	47(75.05)	-		
Overweight (BMI=25 and 29.9kg/ m²)	38(10.67)	2(5.26)	36(94.74)	85.9 [1.416;5214.]		**0.034***
Obese(BMI ≥30kg/m².)	51(14.33)	9(17.65)	42(82.35)	61.15 [0.585;6396]		0,08
Bloodpressure						
NormalBP	270(75.84)	47(17.40)	69(82.6)	Reference		
Hypertensive	86(24.16)	17(17.77)	223(82.23)	1.17 [0.63;2.17.]		0.620
Diabetic	39(10.96)	1(2.56)	38(97.44)	0.85 [0.058;12.6.]		0.91
Viralload HIV-1 (≥100 000 cop/ml)	160 (44.94)	39(24.36)	121(75,64)	0.038 [0.03;0.64]		**0,024***
CD4+ T cellcount(cells/µl)< 200/mm^3	77 (21.63)	21(27.27)	56(73.73)	122.5	[198;7584]	**0.022***
Combinationtherapiesused						
TDF / 3TC / ATZr	17(4.78)	0(0)	17(100)	-	-	-
TDF / 3TC / EFV	75 (21.07))	3(4)	72(96)	-	-	-

TDF / 3TC / DTG	220 (61.80	60(27.27)	160(72.73	-	-	
TDF / FTC / EFV	31(8.70)	1(3.23)	30(96.77)	-	-	-
TDF/3TC/EFV	13(0.27)	0(0)	13(100)	-	-	-

OR=oddsratio;CI=confidenceinterval;*=significant test

DISCUSSION

The results obtained in this study revealed that renal dysfunction was present in people livingwith HIV. Based on the estimation of glomerular filtration rate using the CKD EPI equation,

aprevalenceof18%ofrenaldysfunctionwasfoundinthepresentstudy.Thishighresultiscloseto a similar study conducted in Gondar, Southern Nigeria, which found a prevalence of 16.3%[17].This could be explained by the fact that the Makokou ATC, our study site, is the onlyhealthcarefacilityintheregion,whichisentitledtofollowupHIVpositivepatients.Therearestrict criteriaforearlydetectionofrenaldysfunctioninpatients.Theprevalenceobtainedinthepresent study is higher than studies elsewhere, which reported 7.6% at Jimma UniversitySpecialistHospitalinSouthwesternEthiopia[18],and

12.9%attheUniversityHospitalinthenorthwestern part of the country [19]. This value is higher than those reported in studieselsewhere,whichreported7.6%atJimmaUniversitySpecialistHospitalinSouthWestEthiopi a

[18] and 12.9% at FelegeHiwot Referral Hospital in North-west Ethiopia [19] among PLHIVon antiretroviral therapy. However, this value is lower than those reported among PLHIV inTanzania, which was 20.7% [20], or 24%, in. Côte d'Ivoire [21]; 25.0% in Spain [22], and25.4%inEthiopia[23].Thisvariabilityofresultscould beexplained bythefact that,giventhevariation in patients collected in the different studies, the prevalence of chronic kidney disease(CKD)in HIV-positive subjects worldwide is between 8 and 16%, andvaries from onegeographical region to another, ranging from 2 to 38% [24]. Secondly, by the differencebetweenprimary,secondaryandtertiaryhealthcare facilitiesattended bypatients[25].

Univariate and multivariate logistic regression analyses of socio-demographic and clinicalcharacteristics of the patients in this study indicated that female gender, age, duration ofantiretroviraltherapy,overweight,viralloadandsevereimmunedeficiencyduetoaCD4Tcellcoun t below 200mm^3 were indicated as potential risk factors associated with predisposition todysfunctioninthis study.

Indeed,incontrasttosomepreviousworkthathasshownahighprevalenceofrenaldysfunctioninmen[

26],aunivariateanalysisaccordingtosocio-demographiccharacteristicsofthePLHIV

inthepresentstudyindicatedthatfemalegenderwassignificantly associatedwiththiscondition.Thisisconsistentwiththefactthatinthisstudy,womenhadahigherBMI andwaistcircumference, and lived in a rural area compared to most men who lived in a semi-urban area[27]. Similar to an earlier study, the present study reported greater renal dysfunction in HIV-positive people aged 40 years and older [30]. This resultis different from that obtainedelsewhere, where a decrease in renal function was unexpectedly reported in the younger agegroups, aged 20-39 years [28]. The result of the present study may be consistent with the factthat eGFR decreases with age, as has been reported in other studies that have indicated thatgenerally renal filtration decreases with increasing age [29]. Although some studies haveevaluated the effect of antiretroviral therapy in PLHIV over months [30], a univariate analysisoftheresultsofthepresentstudyisinagreementwiththeirfindings.Indeeditwasindicatedana ssociation between and prevalence of renal dysfunction and PLHIV on antiretroviral therapyfor 6-10 years and ≥11 years. This result corroborates with a study conducted elsewhere [31].Theseresultsarealsoinagreementwithmanyotherstudies,whichhavereportedanassociationbet ween renal failure and duration of antiretroviral therapy [32,]. This result may be supportedbyclinicalevidencefromonestudy,whichreportedthatantiretroviraltherapycancausesev ereproximal tubularinjury andproximal HIVtubulopathy [33].With themajority of studyparticipants (98.5%) using tenofovir disoproxil fumarate (TDF) combination therapy, this mayhave contributed to our finding of renal dysfunction as described in other studies [8]. Thepresentstudyreportedasignificantassociationbetweena BMIbetween25and29.9kg/m²)i.e.ove rweightandpeoplelivingwithHIVonantiretrovirals-thisresultisinagreementwiththoseof many studies that reported hypercholesterolaemia and hypertriglyceridaemia in patients onantiretroviral therapy. [34]. This may be justified by the fact that HIV itself and antiretroviraldrugs influence the partitioning and distribution of the adipose tissue compartment which maypredispose to metabolic complications [35]. The present study found that patients with a viralload of 100,000 copies/ml or more were associated with an increased risk of renal dysfunctionthan their counterparts with lower viral load levels [36]. Similar to a study that reported thatdrug use was associated with poor CD4+ T-cell recovery in HIV-infected individuals onantiretroviral therapy [38], the present study found a significant association between low CD4counts, reflecting severe immune deficiency, and the prevalence of renal dysfunction. Thiscould be explained by the fact that patients with incomplete CD4+ T-cell reconstitution duringantiretroviraltherapyhaveincreasedcomplications,morbidityandmortalityfromcardiovasc ular,liverandkidneydisease [39,40].

Highlights

This study on renal dysfunction in HIV positive patients under antiretroviral treatment is thefirst to be conducted in the province of Ogooué-Ivindo. It gave an idea of the impact of theburdenofrenaldysfunctionandassociatedriskfactorsinHIVpatientsundergoingantiretroviraltreatment.

Study limitations

Althoughthiscross-sectionalstudywasconductedinacenterauthorizedtofollowHIV-positivepatients, the results obtained may not provide a generalizable prevalence of renal dysfunctionamong HIV-positive patients in Gabon, but rather among those attending this OutpatientTreatment Center (CTA-MKK). Therefore, it would be very useful to undertake a multicenterstudy in all health care facilities in the province of Ogooué-Ivindo, and then in Gabon as awhole.

CONCLUSION

This study demonstrated that with a high prevalence of renal dysfunction, people living withHIV/AIDS,underantiretroviraltreatment,attheoutpatienttreatmentcenterofMakokou(CTA-MKK) were confronted with certain risk factors such as female gender, age, duration ofantiretroviral treatment, overweight, viral load and severe immune deficiency due to a CD4 Tlymphocyte count lower than 200mm3, which predisposed them to dysfunction. It would beimportanttoroutinelyscreenHIV-positivepatientsforthisconditionatHIVcareandtreatmentclinic programs. This will allow early detection, treatment and follow-up of HIV-positivepatientsforsuchcomplications.

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Competinginterests

Theauthorsdeclarenocompetinginterests in thepublicationofthisarticle.

Authors'contributions

TNM, HMK, and CB designed and initiated the study. AJEN, CSO wrote the manuscript. CBandTNMperformedthestatisticalanalysis.LCOE,CB;UOS,andTNMmademajorcontributions tothestudydesignandstatisticalanalysis.Allauthorscontributedtothedraftingofthemanuscriptanda pprovedthe submittedversionofthemanuscript**.**

DataAvailability

In order to preserve the confidentiality of the participants, the data generated and analyzedduringthisstudyarenotpubliclyavailable.However,theymaybeavailablefromthecorresp ondingauthoruponreasonablerequest.

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