Factors Associated With Virological Suppression of HIV Viral Load in Patients on Antiretroviral Therapy in Conakry, Guinea

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Research

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Abstract

Background

The viral load has become an indispensable tool in evaluating antiretroviral therapy (ART) in people living with HIV / AIDS. This study aimed to assess virological suppression among in people living with HIV / AIDS on antiretroviral therapy in Guinea.

Methods

This was a descriptive cross-sectional study of more than three years that involved adult HIV-positive patients treated in different sites in Conakry. A total of 9815 viral load data were collected. The viral load was quantified by the Generic Biocentric technique and the detection threshold set at 350 copies/ml. Statistical analyses were performed by R software version R4.0.3..

Results

A total of 9815 viral load data collected at the national public health laboratory were analysed. The sample was dominated by women (72%), with an average age of 29 [29, 39]. Of these, 6,706 (68%) of HIV-positive people on ART had viral load suppression. The univaried analysis showed that women were 22% more likely to have VL suppression (p-value <0.001) moreover, the chance for all HIV-positive people on treatment to achieve viral load suppression was related to the length of treatment.

Conclusion

the results of this study show viral load suppression greater than 68%. The length of antiretroviral therapy, female gender, and advancing age of PLHIV were all favourable to VL suppression.

Introduction

About forty years since discovering the Human Immunodeficiency Virus (HIV), nearly 35 million people have died, and about 36 million people live with the dise(1). With the support of the Global Fund to Fight HIV, Malaria and Tuberculosis combined with a grant from the Guinean government, antiretroviral treatment (ART) was made accessible in 2007(2).Until 2017, Guinea had 142 sites integrated into the care of people living with HIV/AIDS (PLHIV), with only 86 functional (3). According to the latest Demographic and Health Survey (DHS) in 2018, HIV prevalence in Guinea is estimated at 1.5% (4).

Since the United Nations AIDS Programme (UNAIDS) set its target of three out of 90 by the end of 2020, viral load has become the essential tool for assessing the success or otherwise of ART in PLHIV (Kitchen et al., 2020; UNAIDS, 2014). It also allows biological monitoring of these people (5)

The first viral load (VL) tests in Guinea among PLHIV began in 2006 on a cohort of patients followed by the NGO DREAM (an Italian Christian organisation involved in caring for people living with HIV/AIDS). It

was not until 2013 that viral load testing was made available to patients in the active file in Conakry (4).

According to a global progress report on the fight against AIDS in 2019, Guinea has an active file of 61897 people on ART, of whom 26213 have received a viral load test, i.e., 22% of PLWHA. The cascade of care was 52% for screening and treatment and 22% for viral load. About the three UNAIDS 90s, the situation in Guinea is as follows 52% for the 1st 90, 99% for the 2nd 90 and 42% for the 3rd 90(6).

Viral load testing is a key indicator for assessing ART success and diagnosing drug resistance in people living with HIV/AIDS on antiretroviral therapy(7).

Even though the authorities and its partners have multiple efforts, notably the Global Fund, Guinea struggles to reach the third 90 of the UNAIDS targets. Several piecemeal studies have described viral load testing in one category of people living with HIV/AIDS(6,7). No study has focused on many patients receiving VL and the factors associated with its suppression. To address this study, we ask what proportions of people living with HIV/AIDS achieve viral load suppression in the Conakry care sites. What are the factors associated with viral load suppression among PLHIV in Conakry?

Knowing this proportion of PLHIV achieving VL suppression and its associated factors could help develop new strategies for achieving the third 90 of the UNAIDS target.

The objective of this study was to investigate the frequency and factors associated with viral load suppression among PLHIV in the care sites in Conakry.

Methods

Setting and study design

Conakry, the capital of the Republic of Guinea, covers an area of 450 km2 and is populated by nearly 2 300000 inhabitants, meaning a quarter of the Guinean population (8). Conakry is reported to have 22 sites for the care of patients living with HIV/AIDS(2). The National Public Health Laboratory (LNSP) ensures the biological and virological monitoring of all these patients under ARV in the care sites in Conakry outside the Donka National Hospital (3). These were four communal medical centres in Conakry, the Ignace Deen National Hospital, the ASFEGMASSI Outpatient Treatment Centre, the Armed Forces Health Service, the Mother and Child Centre, Bernay Fotoba, of the Medical Center of the campagny of Bauxites of Guinea some private clinics and six health centres. These sites provide care for a large cohort of PLHIV whose virological follow-up is ensured by the National Institute of Public Health.

Study population

The study population consisted of patients living with HIV/AIDS (PLWHA), followed up at care sites affiliated with the National Institute of Public Health and receiving viral load testing between January 2018 and June 2021. Patients with incomplete information were excluded from the study.

Data collection

The molecular biology unit has a database from which we extracted data from January 2018 to June 2021. These data concerned socio-demographic characteristics (age, sex and residence), the reason for requesting a viral load test, the use of ARVs, the date of initiation of treatment, the dates of sampling and analysis, the treatment lines (first, second and third) and treatment regimens as well as the interpretation of the viral load results. According to Guinea's national HIV management protocol, the first line consists of 3TC+TDF+EFV, the second line 3TC+TDF + LPV/r and the third line various combinations sometimes based on 2INRT+ Darunavir/Ritonavir or Raltegravir + Etranvirine (9,10). Patients with a viral load of 390 copies/ml or less were considered virologically suppressed.

Laboratory techniques

RNA was isolated from plasma by an automated method, and amplification was performed as described by the RT-PCR principle using the HIV generic biocentric (11). The detection limit was set at 390copies/µl for a 250 µl plasma sample.

Data analysis

The data description was done by calculating proportions for categorical variables and means for quantitative variables. Comparisons were made using the Chi-2 or Fischer test for categorical variables and Student's t-test for quantitative variables. Factors associated with virological suppression were analysed by univariate or multivariate logistic regression. In multivariate analysis, only variables with a p-value ≤ 0.20 were used in the multivariate model. The Hosmer-Lemeshow test was used—analysis of the accuracy of the model. The risk of suppression was estimated by calculating the Odds Ratio (OR), followed by its 95% confidence interval. The significance level was set at 5%. All statistical analyses were performed using R software version R4.0.3.

Ethical considerations

As the collection was done retrospectively on routine data, consent was not sought. However, each participant has a unique national code, and the staff in charge of collecting the samples maintained confidentiality. The study was approved by the research committee of the public health department of Gamal Abdel Nasser University in Conakry.

Results

A total of 10602 patients were tested for viral load, of which 787 were excluded. Thus, data from 9815 patients were included, i.e., 92.57% (Fig. 1).

Among the 9815 patients included in our study, all were HIV1 positive with a mean age of 29 (29.39) and a female predominance (72%). Nearly 98% of our patients were on first-line antiretroviral therapy. The reason for requesting a viral load test was dominated by routine check-ups (88%). Forty-two percent of

patients had treatment duration of 0–1 year, followed by those with a duration of 1–5 years. Viral load suppression was observed in 68.32% of patients (Table 1).

Univariate analysis of the data showed that women were more likely to have a suppressed viral load, with 95 CI 1.22 (1.11;1.34). Patients on the second line of treatment were 23% less likely to have a suppressed viral load. The longer the treatment, the greater the chance of having a suppressed viral load 1.08 [0.98; 1.19]. It also showed that the advancing age of patients was favourable to viral load suppression (table 2).

Multivariate analysis of the data showed that duration of treatment and female gender were independently related to viral load suppression, 95 CI [0.85 (0.75, 0.95)] < 0.005 (table 3).

Table 1: Sociodemographic characteristics of patients receiving viral load between January 2018 and June 2021 at the National Institute of Public Health

Characteristic	N = 9,815[1]
Gender	
Female	7,067 (72%)
Male	2,748 (28%)
Reason. Sample collection	
VL-reinforcement obs	161 (1.6%)
VL-6months later	572 (5.8%)
VL-Follow-up check	8,614 (88%)
VL-Search	148 (1.5%)
VL-PTME	5 (<0.1%)
VL-initiation	315 (3.2%)
Under Antiretroviral treatment.	
No	27 (0.3%)
Yes	9,788 (100%)
Line. Treatment	
1stline	9,596 (98%)
2ndline	219 (2.2%)
Interpretation.VL	
VL-Not deletion	3,109 (32%)
VL-Deletion	6,706 (68%)
Age (average)	29 (29, 39)
Duration of treatment	
[0,1]	4,158 (42%)
(1,5]	3,548 (36%)
(5,11]	2,109 (21%)
Age at initiation (years)	
[0-20]	553 (5.6%)
(20-40]	7,036 (72%)
(40-60]	2,010 (20%)

Characteristic	N = 9,815[1]
(60-84]	216 (2.2%)
[1] n (%); Median (IQR)	

Table 2: Univariate analysis of factors associated with viral load suppression in patients receiving viral load at the National Institute of Public Health

	VL-Non deletion	VL-Deletion	OR	p.value
	N=3109	*N=6706*		
Gender:				
Male	956 (30.7%)	1792 (26.7%)	Ref.	Ref.
Female	2153 (69.3%)	4914 (73.3%)	1.22 [1.11;1.34]	<0.001
Reason for collection				
VL-observation	91 (2.93%)	70 (1.04%)	Ref.	Ref.
VL -6 months	190 (6.11%)	382 (5.70%)	2.61 [1.83;3.74]	<0.001
VL -Follow-up	2611 (84.0%)	6003 (89.5%)	2.99 [2.18;4.11]	<0.001
VL -Research	83 (2.67%)	65 (0.97%)	1.02 [0.65;1.60]	0.938
VL -PTME	3 (0.10%)	2 (0.03%)	0.89 [0.10;5.98]	0.902
V-initiation	131 (4.21%)	184 (2.74%)	1.82 [1.24;2.68]	0.002
UnderARV treatment				
No	8 (0.26%)	19 (0.28%)	Ref.	Ref.
Yes	3101 (99.7%)	6687 (99.7%)	0.92 [0.37;2.04]	0.841
Treatment line				
1st line	3020 (97.1%)	6576 (98.1%)	Ref.	Ref.
2nd line	89 (2.86%)	130 (1.94%)	0.67 [0.51;0.88]	0.005
Duree treat:				
[0,1]	1385 (44.5%)	2773 (41.4%)	Ref.	Ref.
(1,5]	1120 (36.0%)	2428 (36.2%)	1.08 [0.98;1.19]	0.104
(5,11]	604 (19.4%)	1505 (22.4%)	1.24 [1.11;1.40]	<0.001
Age1:				
[0,20]	230 (7.40%)	323 (4.82%)	Ref.	Ref.
(20,40]	2304 (74.1%)	4732 (70.6%)	1.46 [1.23;1.74]	<0.001
(40,60]	520 (16.7%)	1490 (22.2%)	2.04 [1.68;2.48]	<0.001
(60,84]	55 (1.77%)	161 (2.40%)	2.08 [1.47;2.97]	<0.001

Table 3: Multivariate analysis of factors associated with viral load suppression in patients receiving viral load at the National Institute of Public Health

Characteristic	OR[1]	95% CI[1]	p-value
Gender			
Male	—	—	
Female	0.78	0.71, 0.86	<0.001
Reason. Sample			
VL-Compliance reinforcement	—	—	
VL -6 months	0.38	0.26, 0.54	<0.001
VL -Routine	0.35	0.26, 0.48	<0.001
VL -Research	1.04	0.66, 1.64	0.90
VL-Mother-child prevention	1.04	0.16, 8.22	>0.90
VL -Initiation	0.53	0.36, 0.78	0.001
Under ARV treatment			
No	—	—	
Yes	1.05	0.47, 2.55	>0.90
Treatment line			
1st line	—	—	
2nd line	1.43	1.08, 1.88	0.012
Treatment duration			
[0,1]	—	—	
(1,5]	0.98	0.88, 1.08	0.60
(5,11]	0.85	0.75, 0.95	0.005
Age1			
[0,20]	—	—	
(20,40]	0.98	0.77, 1.26	0.90
(40,60]	1.03	0.70, 1.52	0.90
(60,84]	1.39	0.75, 2.58	0.30
1 OR = Odds Ratio, CI = Confidence Interval			

Discussion

The objective of this study was to investigate the frequency and factors associated with viral load suppression in patients living with HIV/AIDS followed up in care sites in Conakry between January 2018 and June 2021.

The detection threshold was set at 390 copies/ml. This threshold is higher than the one used by some programmes, 200 copies/ml (12). Nevertheless, it is kept below that set by other national HIV/AIDS programmes and the WHO in the absence of any treatment, which is < 1000 copies/ml (13, 14).

Data from more than ten thousand patients receiving viral load testing at the National Institute of Health Public showed that nearly seven out of ten people had a suppressed viral load. This rate is comparable to that reported by Diourra et al., 80% on 379 DBS samples(7). This rate is even lower than the UNAIDS and National AIDS and Hepatitis Control Programme target of 90% by 2020(15). This result also suggests that three out of ten patients could transmit the infection to their contacts even though they are all on antiretroviral treatment. Similar observations have been reported by other authors (14, 16).

In the univariate model of the data from this study, HIV-positive women with viral load at the National Public Health Laboratory were more likely to have VL suppression than men [1.22 (1.11; 1.34) < 0.001]. Kone F et al. showed similar proportions in their study in Côte d'Ivoire(5). This result also shows that men were more likely to have failed to suppress their viral load. It is known in the literature that women attend health services more than men for needs such as childbearing, bodily fragility, to diseases. A study conducted in Guinea on dropouts of patients on antiretroviral treatment showed that the proportion of dropouts was higher among men (2).

Multivariate analyses of the data also showed that treatment duration was independently associated with viral load suppression [0.85 (0.75; 0.95) < 0.005]. Similar observations have been reported by authors (17). Other authors have also reported similar observations in both sub-Saharan African countries and rich countries(18). This could be explained by the reduction in plasma viral load (RNA) over the years. This is contrary to the recommendations of WHO and indeed other agencies that patients on antiretroviral therapy should have viral load suppression after six months.

Patients on first-line ART were more likely to experience viral load suppression. This result is consistent with other authors' observations that the first-line regimen should be initiated in all HIV-positive people starting treatment (14, 19, 20). As argued by some authors for the change from the former to the latter (21). However, the lack of genotyping data to know which non-deleting patients should switch treatment lines handicaps this decision by caregivers in Guinea. Similar observations have been noted by others (22). Unfortunately, this type of test is not yet available in Guinea. These results suggest the need to strengthen education and adherence, as only 1.6% of the patients in this study completed the VL as part of adherence strengthening.

Limitations and strengths

This study, like many others, may have some limitations. These include the lack of clinical data to which the laboratory does not have access and would have facilitated the interpretation of the virological and therapeutic results. Another limitation of the study is that the data concern both the viral load at follow-up and initiation of treatment. However, to our knowledge, our study is one of the largest cohorts in the framework of the follow-up of PLHIV on antiretroviral treatment in Guinea. Even though the study covered an extended period, the patients all benefited from load measurement with the same technique and personnel over all these years.

Conclusion

The results of this study show a low suppression of virological load suppression among the population study. Duration of antiretroviral treatment, female gender, and advancing age were favourable to patients' viral load suppression. Continuation of this study by including genotyping data could refine the level of viral load suppression and manage those in virological failure.

Declarations

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Availability of data and materials

The data supporting the conclusions of this study are available from the corresponding author, [AC], upon reasonable request.

Competing interests

The authors claim to have no conflict of interest

Authors' contributions

The authors

Alimou Camara designed the protocol, participated in the analysis and writhing of the manuscript. Then Penda Maladho Diallo and Mamadou Bobo Diallo helped with the manuscript

Penda Maladho Diallo, Mamadou Bobo Diallo, Talla Nioké, Adama Cissé, Mamadou Alpha Sylla, Gobounet Lamah, Mamady Diakité, and Amadou Sadio Bah contributed to perform laboratory analysis for virogical load of HIV

Alimou Camara, Mamadou Boye Keita, Mamoudou Conde and Alpha Kabimet performed the data analysis, interpreted result and drafted the manuscript with the input from Kaba Kourouma, Robert Camara, Fode Banagaly Magassouba, Alioune Camara, and Abdoulaye Toure.

All others critically revised and approved the final manuscript.

Ethics approval and consent to participate

As the collection was done retrospectively on routine data, consent was not sought. However, each participant has a unique national code, and the staff in charge of collecting the samples maintained confidentiality. The study was approved by the research committee of the public health department of Gamal Abdel Nasser University in Conakry.

Consent for publication

All authors agree to the publication of the manuscript in this journal

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Figures

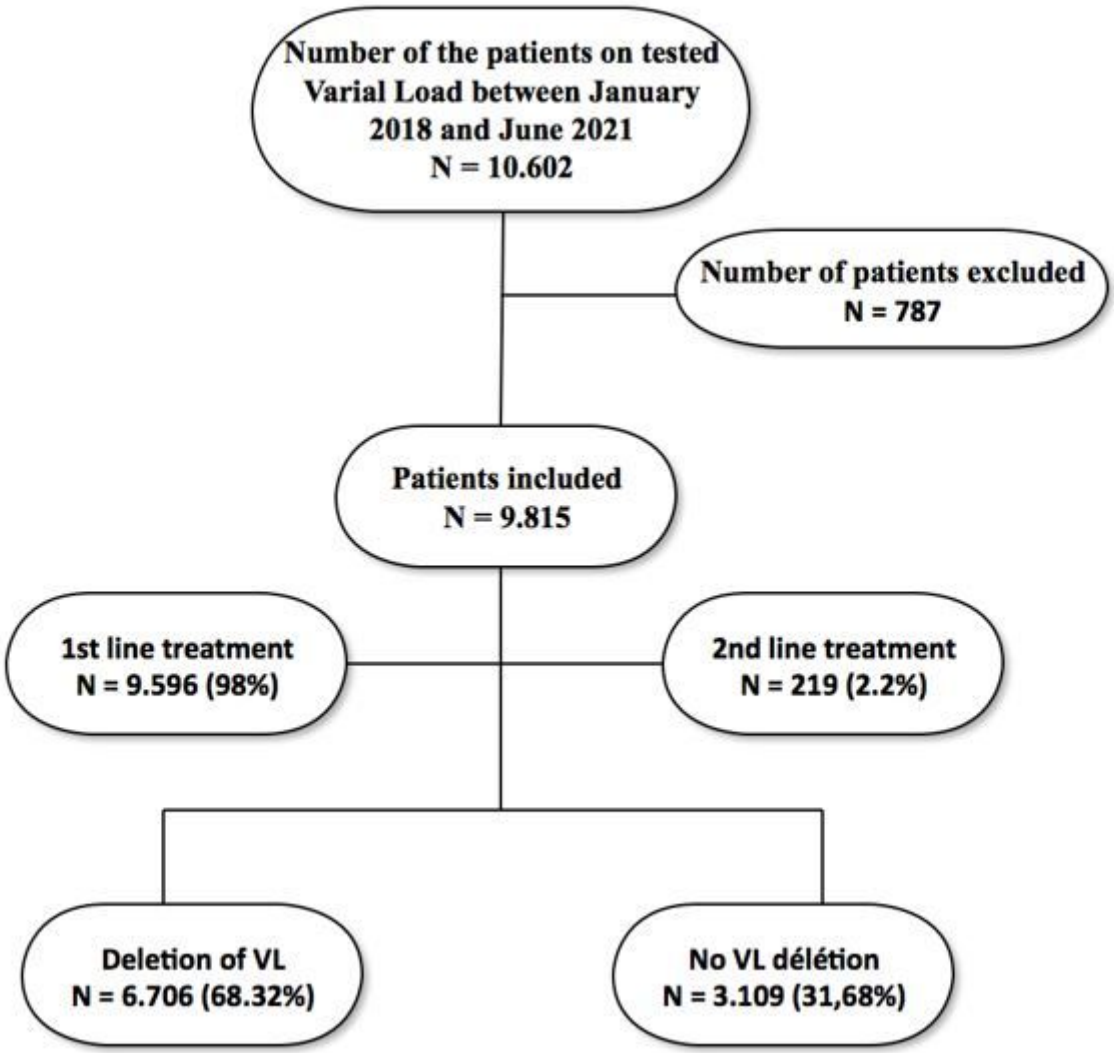

Figure 1

Flow chart summarising all the data from the study Description Data from ten thousand six two patients with viral loads between January 2018 and June 2021 were extracted, from which we excluded 782 whose data were incomplete. We therefore retained 9815 viral load data. Of these, 9596 were on therapeutic line 1 and the rest on line 2. A total of 6706 patients had suppressed viral loads compared to 3109 patients with detectable viral loads.