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Molecular Evaluation of HIV-1 HAART Efficacy, Comparison of TDF+3TC+EFV and AZT+3TC+NVP Regimens

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Abstract

Context: The UNAIDS goal of ending the HIV epidemic by 2030 will be achieved primarily through the success of the three “95s” by 2030, and in particular the third “95 », which consists of achieving an undetectable viral load thanks to effective antiretroviral treatment. Achieving and maintaining viral suppression is the goal of ART and a good knowledge of the effectiveness of triple ARV therapies can help national HIV programs. Thus, the objective of this study was to evaluate and compare the effectiveness of the two ARTs, Tenovofir + Lamivudine +Efavirenz (TDF+3TC+EFV) and Zidovudine+Lamivudine+ Efavirenz (AZT+3TC+NVP) in their abilities to make the plasma viral load of HIV+ patients under treatment undetectable.

Material and method: This is a retrospective study of the management of HIV-1 seropositive patients, followed at the Military Hospital of Ouakam (HMO) Molecular Biology laboratory from 2014 to 2021. The main criterion for evaluating the effectiveness of the treatment was the proportions of patients whose Viral load values were undetectable, VL< 50 copies/ml depending on duration of antiretroviral therapy (ART). Plasma viral load tests were carried out on Abbott Real Time HIV-1® (m2000sp/rt) and COBAS®AmpliPrep/COBAS®TaqMan® (Roche) version 2.0. Variables with $p<0.05$ were considered statistically significant for all comparisons between groups.

Results: 3,335 patients met the inclusion criteria, including 2,078 on TDF+3TC+EFV, 445 on AZT+3TC+NVP and 812 were excluded due to death, transfer or loss to follow-up. At 6 months of ART, VL was undetectable in 7.3% of patients on TDF+3TC+EFV and 6.7% of patients on AZT+3TC+NVP (P=0.67). 78.2% versus 73.4% of patients had an undetectable VL respectively for TDF+3TC+EFV and AZT+3TC+NVP at 12 months of ART (p=0.03). TDF+3TC+EFV had significantly higher virological success rates than AZT+3TC+NVP (85.7% versus 80.2%) and virological failure (VL>1000 copies/ml) was significantly greater in patients taking AZT+3TC+NVP (13% versus 7.2%) after 18 months (P=0.001). Gender and age had a significant relationship in treatment success.

Conclusion: TDF+3TC+EFV was superior in terms of virological suppression at the end of the study period. These results support the WHO recommendation to use TDF+3TD+EFV as an alternative first-line regimen.

Keywords: HIV, ART Regimens, comparison, efficacy

1. Introduction

The HIV pandemic remains the most serious infectious challenge in public health and AIDS remains the leading

cause of mortality in Africa and the 4th in the world (Dolo, 2011; Delaunay et al., 1999).

According to the UNAIDS report, in 2022, the number of people living with HIV worldwide was estimated at 38.4 million. In sub-Saharan Africa, approximately 25.6 million people live with HIV, or 67.5% of the total infected population worldwide (ONUSIDA, 2022). The AIDS epidemic in Senegal is concentrated with low prevalence in the general population and high in certain localities and among key populations (sex workers and men who have sex with men) (CNLS, 2020). According to data from the national AIDS response report in Senegal for the year 2021, the estimated number of PLHIV (adults and children) was estimated at 40,277 people including nearly 21,703 women and 3,957 children under 15 (CNLS, 2021). The introduction of highly active antiretroviral therapy (ART) as a treatment for HIV infection has significantly decreased the morbidity and mortality of people living with HIV worldwide.

From 2000 to 2021, AIDS-related deaths have been reduced by 1.7 million people to 650,000 globally. And since 2010, new HIV infections have decreased by 32%, from 2.2 million to 1.5 million in 2021 (ONUSIDA, 2022). This gradual reduction in prevalence and new infections is possible thanks to free access to antiretroviral treatments (ARV) in several regions and the advent of triple antiretroviral therapy (ART). Indeed, efforts in terms of treatment and prevention to achieve the "95-95-95" objective by 2025 have made it possible to facilitate access to antiretroviral treatment which has increased from 560,000 to 28.7 million HIV+ people. Under treatment in 2021 worldwide so that 95% of PLHIV have an undetectable viral load (ONUSIDA, 2022).

UNAIDS' targets for ending the HIV/AIDS epidemic by 2030 are: 95% of people living with HIV know their HIV status, 95% of people living with HIV receive antiretroviral treatment, and 95% of people living with HIV receive antiretroviral treatment and 95 % of people receiving antiretroviral treatment achieve viral suppression (FQS, 2022). Today, while the overall situation in the fight against AIDS presents encouraging results in terms of screening, access to treatment and viral load, West and Central Africa is lagging behind in achievement of these objectives. For the third "95", West and Central Africa has an undetectable viral load coverage rate for all people living with HIV of 59% compared to 90% globally in 2021 (ATLAS, 2021). In Senegal, in 2019, 87% of diagnosed PLHIV are under treatment and 81% have viral suppression. This coverage increased from 71% in 2017 to 81% in 2019. Access to viral load increased from 41% to 57% (ONUSIDA, 2020). Antiretroviral treatment should make the patient's viral load undetectable (<50 copies/ml), promoting immune restoration, decreasing the risk of viral drug resistance and reducing HIV-associated clinical events (Peeteers, Jung & Ayouba, 2013). Early initiation of antiretroviral therapy results in a rapid decline in viral load, which reduces the risk of HIV transmission (Cohen, Chen, McClauley, Gambie et al., 2016).

The main challenge for eliminating HIV in 2030 is the third "95", which consists of achieving an undetectable viral load for HIV patients on treatment.

Several studies showing the limits of CD4 measurement in the management of HIV-positive patients have made viral load the main prognostic marker for progression and therapeutic monitoring (Reynolds, Nakigozi et al., 2009). Measuring plasma viral load makes it possible to assess the progression of infection, the effectiveness of antiretroviral treatment and the appearance of resistant HIV genotypes. Genetic variability gives HIV resistance to ARVs and is the cause of therapeutic failures. It results from the rate of nucleotide incorporation errors made by reverse transcriptase during the reverse transcription of the viral RNA into DNA and this error rate is 1 to 10 mutations per genome and per cycle. This step is the target of drugs from the family of nucleoside reverse transcriptase inhibitors (INRT) such as TDF, AZT and non-nucleoside reverse transcriptase inhibitors (INNRT) for example, EFV (Peeters, Toure-Kane & Nkengasong, 2003; Thaczuk et al., 2011; Isel, Ehresmen & Marquet, 2010). The factor for lasting HIV viral suppression is maintaining an ARV regimen that is effective and tolerated by the patient. Adherence to ARV treatment is necessary to prevent the emergence and replication of resistant HIV genotypes (ONUSIDA, 2022). Forgetting to take, stopping and then restarting treatment can promote HIV resistance to ARV (ONUSIDA, 2022). Given the genomic variability and resistance of HIV to ARVs, a study of the effectiveness of therapeutic combinations remains necessary to understand the impact of changing treatment regimens on the CV results of people living with HIV in Senegal. Thus, it would be interesting and even important to update and evaluate the effectiveness of nucleoside reverse transcriptase inhibitors of therapeutic combinations of different classes available in regions with limited resources for better monitoring of treatment and viral load but also to know the best therapeutic regimen to adopt in the treatment of HIV. Our study aimed to compare the virological effectiveness of two regimens TDF+3TC+EFV and AZT+3TC+NVP in the treatment of HIV infection in their ability to suppress the plasma viral load below the detection threshold of the molecular method used.

2. Material and Methods

2.1 Study Population

Plasma samples from HIV-1+ patients on ART TDF+3TC+EFV and AZT+3TC+NVP were collected at the Molecular Biology Laboratory of the AIDS Program of the Senegalese Armed Forces at the Ouakam Military Hospital in Dakar from 2014 to 2021. Consent was not required for these patients because plasma VL was performed as part of their clinical follow-up for their ART. However, patient data was anonymized. The evaluation of the TDF+3TC+EFV (Atripla) and AZT+3TC+NVP regimens was carried out from the initiation of treatment until the 18th month (M0 to M18) with half-yearly or annual monitoring. To be eligible, HIV-1 positive patients had to receive at least 6 months of ART.

2.2 Sample Collection

Whole blood was collected in 5 ml BD K2E (EDTA) tubes (ref 368861) (Becton Dickinson, NJ, USA). After centrifugation at 6000 rpm for 20 minutes at 4 ℃, two aliquots of plasma were prepared for each patient, one for testing on Roche or Abbott and the other in reserve, immediately frozen at -80 ℃ until testing. For each sample taken, an analysis report was submitted to each patient with the patient's identifier, age, sex, patient's HIV status, duration of ART and virological data.

2.3 HIV Viral Load Measurement Techniques

Each plasma sample was processed on either Abbott (m2000sp/m2000rt) or Roche (COBAS® AmpliPrep/COBAS® TaqMan® HIV-1 v2.0) for HIV-1 RNA quantification.

2.3.1 Abbott Real Time HIV-1® (m2000sp/rt)

The Abbott test (m2000sp/m2000sp) is a real-time reverse transcriptase PCR test for the quantitative determination of HIV-1 RNA in HIV-1 positive plasma. Extraction is done using 0.6 ml of plasma, reverse transcriptase is followed by real-time amplification and detection of a fragment of the integrase region of the pol gene (pol/IN) of the genome of the HIV-1 with the m2000rt fluorescent probe test kit (Huang et al., 2007). The Abbott platform detects the majority of HIV-1 M variants, A-H subtypes and CRFs such as CRF01_AE and CRF02_AG, and also N and O divergent groups; in a range of linearity ranging from 40 to 107 copies/ml. Plasma samples are tested in the m2000sp/m2000rt instrument according to the manufacturer's instructions. The Abbott instrument is a closed automation system combining extraction, reverse transcriptase, PCR and real-time detection, reducing the risk of contamination. Each series of tests includes three controls (one negative, one strong positive and one weak positive). The analyzer automatically validates the manipulation and determines the presence or absence of HIV-1 nucleic acids according to a threshold cycle value (Ct value) which corresponds to the PCR cycle from which the signal detected indicates the presence of the amplicons. The analyzer automatically validates the manipulation and determines the presence or absence of HIV-1 nucleic acids according to a threshold cycle value (Ct value) which corresponds to the PCR cycle from which the signal detected indicates the presence of the amplicons.

2.3.2 Roche COBAS® AmpliPrep/TaqMan

The COBAS® AmpliPrep/COBAS® TaqMan® HIV-1 v2.0 (Roche Molecular Systems, Inc, NJ, USA) is a real-time reverse transcriptase PCR test. The extraction is done using the COBAS® AmpliPrep, using 1 ml of plasma (COBAS, 2013). Next, reverse transcriptase is initiated automatically, followed by in vitro amplification and simultaneous detection of the highly conserved region of the gag gene and the LTR (long terminal repeat) region of the HIV-1 genome using a TaqMan fluorescent probe (COBAS®TaqMan® 96). This test quantifies RNA over a range of 20-10,000,000 (1.3-7 log10) copies/ml (Scoot, Carmona & Stevens, 2009). Plasma samples are tested in the Roche CAP/CTM96 instrument according to the manufacturer's instructions. The CAP/CTM instrument is a closed automation The Abbott instrument is a closed automation system combining extraction, reverse transcriptase, PCR and real-time detection, reducing the risk of contamination. Each series of tests includes three controls (one negative, one strong positive and one weak positive). The analyzer automatically validates the manipulation and determines the presence or absence of HIV-1 nucleic acids according to a threshold cycle value (Ct value) which corresponds to the PCR cycle from which the signal detected indicates the presence of the amplicons. The quantification of VL using the Roche system was subject to an external quality assessment in 2018 by the College of American Pathologists (CAP) which deemed the results reliable.

2.4 Statistical Analysis

Data acquisition and analysis were carried out using Excel 2013 and SPSS version 21 software. Descriptive statistics were used to describe the demographic and virological characteristics in terms of percentage or median

values. Statistical crossing was used for data comparison using the Chi-square test for proportions and Fisher's exact test for dichotomous variables with a theoretical significance level of 5% ($p<0.05$), considered statistically significant for all comparisons between groups.

3. Results

The primary endpoint of treatment efficacy was the proportion of patients with undetectable plasma viral load values (CV < 50 copies/ml) by treatment duration. Virological success was defined by a plasma viral load below the detection limit of the test used (CV<50 copies/ml), the virological evolution as being a reduction in the level of plasma CV (CV<1000 copies /ml) but not resulting in an undetectable viral load. Virological failure was defined as either viral load rebound (CV > 1000 copies/ml after previously being undetectable) or after measuring two successive viral load values >1000 copies/ml after 18 months of treatment.

A cohort of 3,335 ARV treatment-naive patients. According to the inclusion criteria, 2,523 patients were admitted to the study, including 2,078 under TDF+3TC+EFV and 445 under AZT+3TC+NVP. And 812 patients were excluded due to death, transfer and loss to follow-up (Figure 1).

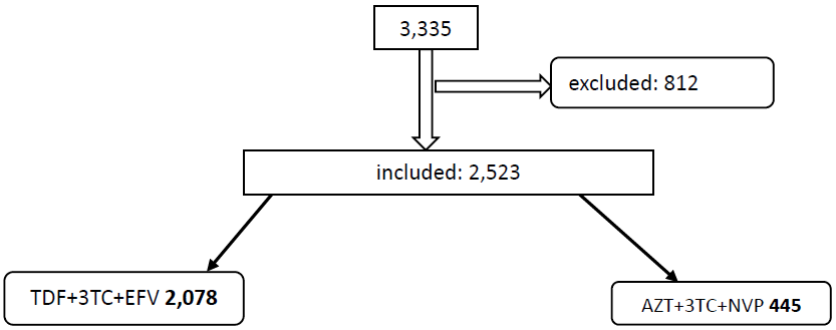

Figure 1. Patient selection

3.1 Demographic Characteristics of the Study Population

In patients on TDF+3TC+EFV, the median age was 38 years and 54.2% of patients were aged 25 to 45 years. Women represented 71% of patients and the sex ratio F/M=1.9.

For the cohort of patients on AZT+3TC+NVP, the median age was 33 years and 39.7% were aged 25 to 45 years. Women represented 71.2% patients and the F/M sex ratio was 2.5.

3.2 Effectiveness of ART, TDF+3TC+EFV and AZT+3TC+NVP

At 6 months of treatment, VL was undetectable in 7.3% of patients on TDF+3TC+EFV and 6.7% of patients on AZT+3TC+NVP (P=0.67). At 12 months, the rate of undetectable was significantly higher in patients taking TDF+3TC+EFV (78.2%) compared to those taking AZT+3TC+NVP (73.4%; p=0.03). After 18 months, 87.5% of patients on TDF+3TC+EFV and 80.2% of patients on AZT+3TC+NVP had undetectable CV. (Table 1).

Table 1. Proportions of undetectable CV, therapeutic effectiveness, and failure from M0 to M18 of TDF+3TC+EFV and AZT+3TC+NVP regimens

Viral load undetectability rate according to duration of treatment						
regimens		6 month	12 month	18 month	Virological Evolution	Virological Failure
TDF+3TC+EFV	n	152	1,625	1,818	111	149
(2,078)	**(%)**	**(7.3%)**	**(78.2%)**	**(87.5%)**	**(5.3%)**	**(7.2%)**
AZT+3TC+NVP	n	30	327	357	30	58
(445)	**(%)**	**(6.7%)**	**(73.4%)**	**(80.2%)**	**(6.7%)**	**(13%)**
P-value		0.67	**0.03**	**0.001**	**0.1**	**0.001**

Virological suppression was achieved for all two regimens used, but it was significantly greater for the TDF+3TC+EFV regimen than with AZT+3TC+NVP (p=0.001).

The virological evolution consisting of a decrease in the viral load to a level below 1,000 copies/ml but not undetectable had no significant difference between the two regimens (P = 0.1; Table 1). Virological failure (VL>1,000 copies/ml) was significantly greater in patients on AZT+3TC+NVP, 13% compared to 7.2% for

patients on TDF+3TC+EFV (p = 0.001; Table 1).

3.3 Efficacy of TDF+3TC+EFV and AZT+3TC+NVP according to Gender

Table 2. Comparison of TDF+3TC+EFV and AZT+3TC+NVP effectiveness according to sex

	Undetectable		**Evolution**		**Failure**	
	Men	**Women**	**Men**	**Women**	**Men**	**Women**
TDF+3TC+EFV	605	1213	41	70	64	85
(M=710**) (F**=1368**)**	**(85.2%)**	**(88.7%)**	**(5.8%)**	**(5.1%)**	**(9%)**	**(6.2%)**
AZT+3TC+NVP	84	273	18	12	26	32
(M=128) (F=317)	**(65.6%)**	**(86.1%)**	**(14%)**	**(3.8%)**	**(20.3%)**	**(10%)**
P-value	**0.001**		**0.02**		0.8	

Table 3. Comparison of TDF+3TC+EFV and AZT+3TC+NVP effectiveness according to age

Age group (years)	**Treatment duration**	**TDF+3TC+EFV n (%)**	**AZT+3TC+NVP n (%)**	**P-value**
	6 month	32 (11.5%)	16 (9.4%)	0.6
	12 month	197 (70.9%)	94 (55.2%)	**0.02**
[0 – 25]	**18 month**	8 (2.9%)	0	-
	Evolution	24 (8.6%)	21 (12.3%)	**0.001**
	Failure	22 (7.9)	39 (22.9%)	**0.001**
	6 month	85 (7.5%)	12 (6.8%)	0.7
	12 month	886 (78.6%)	145 (81.9%)	0.3
[25 – 45]	**18 month**	21 (1.9%)	0	-
	Evolution	49 (4.3%)	6 (3.4%)	0.8
	Failure	84 (7.5%)	14 (7.9%)	0.8
	6 month	33 (5.3%)	2 (1.2%)	0.2
	12 month	504 (80.5%)	81 (89.1%)	0.05
[45 -65]	**18 month**	10 (1.6%)	0	-
	Evolution	37 (5.9%)	3 (3.3%)	0.5
	Failure	43 (6.9%)	5 (5.4%)	0.5
	6 month	2 (4.3%)	0	0.4
	12 month	47 (97.9%)	7 (100%)	0.2
> 65	**18 month**	2 (4.2%)	0	-
	Evolution	1 (2.1%)	0	-
	Failure	1 (2.1%)	0	-

Virological suppression was 85.2% and 88.7% for patients on TFD+3TC+EFV and 65.6% and 86.1% for patients on AZT+3TC+NVP in men and women respectively. Viral suppression was greater in women than in men for both regimens and was greater for the TDF+3TC+EFV regimen (p=0.001). AZT+3TC+NVP had a better positive virological outcome than TDF+3TC+EFV, 14% versus 5.8% in men (P = 0.02; Table 3). Therapeutic failure was greater in men (20.3%) than in women (10%) for the AZT+3TC+NVP regimen than for TDF+3TC+EFV 6.2% and 9% respectively (P=0.8; Table 3).

3.4 Efficacy of TDF+3TC+EFV and AZT+3TC+NVP according to Age

At 6 months of ART, there was no significant difference in undetectable viral load rate between the two regimens regardless of the age of the patients (Table III). At 12 months of treatment, the undetectable viral load rate was 70.9% and 55.2% of patients aged 0 to 25 years taking TDF+3TC+EFV and AZT+3TC+NVP, respectively (P=0.02). For the same duration of treatment this rate was 80.5% and 89.1% respectively for patients on TDF+3TC+EFV and AZT+3TC+NVP for the 45–65-year-old age group (P=0.05). The effectiveness of the treatment was higher for TDF+3TC+EFV only for patients aged between 0-25 years for a duration of 12 months (Table 3). Patients in the AZT+3TC+NVP group aged 0 to 25 years had better virological progress (12.3%) but with a significantly higher failure rate (22.9%) (P=0.001).

4. Discussion

Sustained suppression of HIV replication depends on the use of potent, well-tolerated antiretroviral regimens that patients can easily adhere to. The study of the effectiveness of antiretroviral regimens is fundamental, it makes it possible to give directives to national programs to combat HIV/AIDS with a view to limiting failures.

Viral load is an irreplaceable indicator for measuring the effectiveness of ARV treatments, particularly viral regression or suppression and the appearance of resistant HIV genotypes (Ngom, 2018). Monitoring VL helps avoid inappropriate treatment changes and helps prolong the duration and effectiveness of first-line treatments (OMS, 2015).

Our results obtained show that at 6 months of treatment in patients on TDF+3TC+EFV, 7.3% had an undetectable CV and 6.7% in patients on AZT+3TC+NVP. The two regimens had no difference in effectiveness in the first 6 months of treatment (P=0.67). This result is different from those obtained by Dolo in 2011 in Mali which presented a viral suppression of 30.2% (Dolo, 2011). In Senegal, higher undetectability rates of 46.7% and 24.4% were found for the TDF+3TC+EFV and AZT+3TC+NVP regimens after six months of treatment (Bar, 2016). At 12 months, the undetectable viral load was significantly higher in patients taking TDF+3TC+EFV than those taking AZT+3TC+NVP (P=0.03). This suggests that most patients require a treatment duration of one year to demonstrate virological success. These results are similar to those reported by Boender et al in 2015 and Bartlet et al in 2010 in resource-limited countries who found proportions of viral suppression of TDF+3TC+EFV of 85.6% and 76% respectively at 12 months. (Boender et al., 2015; Bartlett, Chen & Quinn, 2007). This superiority of TDF+3TC+EFV over AZT+3TC+NVP was maintained at 18 months of treatment with 87.5% virological suppression compared to 80.2% (p =0.001). Studies carried out in Senegal by Diop et al in 2013 and Ladman et al in 2009 revealed similar results with 71% and 72% of patients respectively presenting virological suppression with TDF+3TC+EFV after 24 months (Diop et al., 2013 ; Landman et al, 2009). This result is supported by a study which showed that TDF was more effective and less toxic than AZT and that the average reduction in plasma HIV-1 viral load was 1.4 log for TDF compared to 0.5 log for AZT monotherapy. AZT was the cause of anemia (Louie et al., 2003). Our results support the in vitro effectiveness of EFV superior to that of NVP on wild genotypes and on variants resistant to ARVs (Sluis-Cremer, Tachedjian, Mechanisms, 2008; Scarsi et al., 2010; Darin, Scarsi, Meloni, Rawizza & Kanki, 2010.

At the end of the study, virological failure (CV>1,000 copies/ml) was significantly higher in patients on AZT+3TC+NVP 13% compared to 7.2% in the TDF+3TC+EFV group. A failure rate of 10% was found in Nigeria after 12 months (Scarsi et al., 2010; Darin, Scarsi, Meloni, Rawizza & Kanki, 2010) and 3% after two years of treatment for AZT+3TC+NVP (Rey et al., 2009). TDF+3TC+EFV had virological failure rates of 10% and 17% for 12-month treatment aiming for a viral load below 400 copies/ml (Gallant et al., 2004; Keisser t al., 2005) and 3%, 13%, 17% for a 12-month treatment whose objective was a viral load below 50 copies/ml (Keisser et al., 2005; Markowitz et al., 2007; DeJesus et al., 2008., Maggiolo et al., 2006) Depending on the objective of the treatment, the duration and the regime, the failure rate varies. Comparative studies have shown a non-significant difference between TDF+3TC+EFV and other first-line regimens (Tang, Kanki & 2012). Our results are in agreement with those of van Leth F, et al and van den Berg-Wolf M et al, who indicated a higher virological failure for regimens with NVP compared to those containing EFV (Leth et al., 2004; Berg-Wolf et al., 2008). EFV was associated with a reduction in virological failure compared to NVP according to several studies in South Africa, the USA and the United Kingdom (Nachega et al., 2008; Keiser et al., 2002; Matthews et al., 2002).

Indeed, the origin of virological failure is multifactorial, it is often due to poor compliance, pharmacokinetic causes, but also to antiretroviral resistance mutations.

Our results showed that patient gender had a significant link on the success of the treatment. Virological suppression was much greater in women (88.7%) than in men (85.2%) under TDF+3TC+EFV, and for AZT+3TC+NVP 65.6% of men compared to 86.1% in women. In a same-sex cohort, efficacy was greater for TDF+3TC+EFV (P=0.001). Therapeutic failure was higher in men (20.3%) and women (10%) under AZT+3TC+NVP than those under TDF+3TC+EFV 6.2% and 9% (p=0.8).

At present, there is little observational data published in low-resource countries on virological success when comparing TDF+3TC+EFV and AZT+3TC+NVP. In our study we observed considerably lower virological success rates under AZT+3TC+NVP, TDF+3TC+EFV was better in terms of viral suppression. Indeed, in 2013 the WHO recommended the combination of TDF+3TC+EFV as first-line treatment for HIV infection due to its effectiveness, ease of use, safety profile and its unique resistance profile (OMS, 2013). WHO guidelines are supported by our results, particularly due to the risk of anemia associated with AZT (Landman et al., 2009). However, antiretroviral potency, immuno-virological reconstruction, tolerability and drug-related toxicity are important factors to include when evaluating the effectiveness of antiretroviral therapy. The patient file did not include information on treatment compliance, adverse effects due to medications and resistance to ARVs; we were unable to study the link between virological failure and its parameters. These aspects studied will make it possible to know precisely the exact causes of therapeutic failures.

5. Conclusion

TDF+3TC+EFV showed greater virological suppression than AZT+3TC+NVP after 18 months of treatment, which is consistent with its use as a first-line ART regimen. Moreover, these results support the WHO recommendation to use TDF+3TD+EFV as first-line treatment. Viral suppression was linked to the sex and age of patients. The ideal duration to obtain a good rate of undetectability in Senegal is at least 12 months of treatment. It would therefore be interesting to carry out a comparative study evaluating virological suppression between the TDF+3TC+EFV regimen and dolutegravir-based treatment in a context of limited resources.

Conflict of Interests

The author declares that there is no conflict of interests regarding the publication of this paper.

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