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Evolution of HBV Viral Load during Clinical and Biological Follow-Up of Chronic Hepatitis B Patients at the Saint Camille Hospital in Ouagadougou

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Abstract

Hepatitis B virus (HBV) infection is a major public health problem worldwide. The aim of this study was to document the dynamics of HBV viral load during the follow-up of chronic hepatitis B patients at the Saint Camille Hospital in Ouagadougou (HOSCO) from 2017 to 2021. This descriptive retrospective study was carried out in the Hepato-Gastro-Enterology Department of HOSCO and focused on patients who were undergoing treatment for chronic viral hepatitis B. A total of 260 cases of chronic hepatitis B were included in the study. The most affected age group was 21 to 30 years, accounting for 48.08% of the cases. Lifestyle factors included alcohol consumption (3.08%) and tobacco use (2.69%). Major risk factors for transmission included lack of vaccination (98.46%), family history of HBV infection (68.00%) and engagement in high-risk activities (28.00%). Patients requiring treatment were prescribed Tenofovir 300 mg tablets. FibroScan® showed the presence of stage F3-F4 fibrosis (2.14%) and S3 steatosis (13.33%). After one year of follow-up, 6.92% of patients achieved an undetectable viral load with normalized transaminase levels. The majority of other patients had a detectable viral load but below 20,000 IU/mL. The prevalence of viral hepatitis B remains significant worldwide. Although effective and well-monitored treatment can lead to undetectable viremia, prevention remains the most effective strategy for successful

management of this disease.

Keywords

Chronic Viral Hepatitis B, Viral DNA, Follow-Up, Evolution of Viral Load

1. Introduction

Hepatitis B virus (HBV) infection is a global public health problem. According to the World Health Organization (WHO), 296 million people were living with chronic hepatitis B in 2019 and an estimated 1.5 million new infections occur annually [1] [2]. Among the five viruses (A, B, C, D, and E) that can cause acute viral hepatitis, only viruses B, C, and D are known to lead to chronic hepatitis [3]. HBV infection can result in liver inflammation, which may either resolve without treatment within six months or progress to a chronic state. In cases of chronic infection, liver cells are damaged, and the scar tissue formed becomes a potential site for the development of cirrhosis or liver cancer. In Asia and Africa, most cases of infection occur during the perinatal period and in early childhood. Often, these infections go unnoticed until adulthood, when complications associated with chronic infection become symptomatic [4] [5]. In 2019, worldwide, approximately 820,000 individuals lost their lives [1] [2] due to complications related to hepatitis B infection, primarily liver cirrhosis or hepatocellular carcinoma [1] [2] [5].

The prevalence of chronic viral hepatitis B varies significantly across different regions of the world. The African continent is recognized as an endemic area for this condition, although the prevalence varies considerably from one country to another. While it is estimated to be between 2% and 4% in North Africa, it surpasses 12% in certain areas of sub-Saharan Africa [6] [7], where approximately 65 million individuals are chronic carriers [8]. Burkina Faso, with an overall prevalence of 9.1%, is among the regions with high endemicity, characterized by a high rate of Ag-HBs carriers [5]. This presents a substantial health challenge. Despite numerous studies on chronic viral hepatitis B in Burkina Faso, there is a scarcity of data regarding the evolution of HBV viral load during the follow-up of this disease. This scarcity is likely due to the high cost of viral load testing for most patients and the limited availability of this test in peripheral health facilities.

In Burkina Faso, the Saint Camille Hospital in Ouagadougou (HOSCO) is a health facility that provides affordable HBV DNA testing services through one of its branches, Pietro Annigoni Biomolecular Research Center (CERBA Ouagadougou). This initiative allows for comprehensive patient care. The aim of this study was to assess the evolution of HBV viral load during the patient follow-up at HOSCO, Burkina Faso to enhance their medical management.

2. Material and Methods

2.1. Type and Period of Study

This was a descriptive cross-sectional study with retrospective data collection, spanning a four-year period from January 4, 2017, to September 24, 2021. The study was conducted at the Hepato-Gastro-Enterology Department of the Saint Camille Hospital in Ouagadougou (HOSCO).

2.2. Study Population

The study population consisted of patients with chronic viral hepatitis B, all followed in the Hepato-Gastro-Enterology department of HOSCO.

2.3. Inclusion Criteria

Patients of both sexes diagnosed with chronic viral hepatitis B during the study period, with clinical and biological follow-up and available medical records, were included in the study.

2.4. Data Collection

This was an exhaustive census that included all patients who met the selection criteria. The dependent variable was the patient's status with chronic viral hepatitis B. The independent variables were categorized as follows: sociodemographic variables (sex, age, occupation, place of residence, marital status), clinical variables (medical history, risk factors, clinical signs, complications), paraclinical variables (biological, biochemical, morphological, and virological parameters), and therapeutic variables. These variables were collected from patients' follow-up medical records.

2.5. Data Analysis

The data were entered and processed on a microcomputer using Epi Info software version 7.2.2.6. Additionally, Excel 2016 software was employed for generating graphics. Statistical comparisons were conducted using the chi-square (χ^2) test, and significance was determined for p-values less than 0.05.

2.6. Ethical Considerations

Anonymity and confidentiality were maintained throughout the data collection and processing procedures.

3. Results

3.1. Socio-Demographic Aspects

A total of 260 patients were registered during the study period. Among them, 138 patients (53.08%) were women and 122 patients (46.92%) were men, which gives a male/female sex ratio of 0.88. The mean age of the patients was 31.41 ± 8.56 years, ranging from 7 to 75 years. The most prevalent age group consisted

of patients aged 21 to 30 years, comprising 48.08% of the cohort. Most of our patients were married, accounting for 52.69% of the total (Table 1).

3.2. Clinical Aspects

Two patients, accounting for 0.77% of the total, had a known history of hypertension, with one of them receiving regular monitoring. Eight patients, equivalent to 3.08%, reported alcohol consumption, while seven out of 260 patients (2.69%) were smokers (Table 2). Additionally, seventeen patients out of 260 (6.54%) reported a family history of HBV infection, and seven patients (2.69%) were engaged in high-risk professions, including healthcare and road workers. Notably, one case of co-infection involving HBV and HIV type 1, representing 0.38% of the cohort, was documented.

3.3. Paraclinical Aspects

All patients of the study underwent viral load testing every six months or annually, with an average determination of transaminase levels every quarter. During the first follow-up, forty-four (44) patients had a viral load exceeding

Table 1. Sociodemographic characteristics of patients with chronic viral hepatitis B.

Characteristics n = 260	N	Percentage
Age groups (years)		
<20	13	5.00
21 to 30	125	48.08
31 to 40	91	35.00
≥41	31	11.92
Sex		
Female	138	53.08
Male	122	46.92
Occupation		
Government employee	99	38.08
Pupil/Student	71	27.31
Trader	19	7.31
Farmer	4	1.54
Retirement	2	0.77
Others	65	25.00
Marital status		
Married	137	52.69
Single	74	28.46
Domestic partnership	36	13.85
Not specified	13	5.00

Table 2. Distribution of patients according to factors associated with undetectable viral load and socio-demographics. clinical and biological parameters.

Variables	Detectable viral load n (%)	Undetectable viral load n (%)	p-value
Sex, n = 260			
Female	126 (91.30%)	12 (8.70%)	<0.0001
Male	116 (95.08%)	6 (4.92%)	-
Total	242	18	
Age, n = 260			
[27 - 31]	80 (90.91%)	8 (9.09%)	<0.0001
[32 - 36]	100 (92.59%)	8 (7.41%)	<0.0001
[37 - 41]	60 (98.36%)	1 (1.16%)	-
≥56	2 (66.67%)	1 (33.33%)	-
Alcohol consumption, n = 8	7 (87.50%)	1 (12.50%)	-
Tobacco by viral load, n = 7	7 (100%)	0 (0%)	-
Presence of co-infection, n = 1	1 (100%)	0 (0%)	-
Normal biology, n = 260	242 (93.07%)	18 (6.93%)	<0.0001
Presence of hepatomegaly, n = 34	34 (100%)	0 (0%)	-
F3-F4 fibrosis, n = 5	5 (100%)	0 (0%)	-

200,000 IU/mL (16.93%) (Table 3). Additionally, fifty (50) patients exhibited ALT levels exceeding 35 IU/L (19.53%).

All patients underwent an initial assessment, which included AgHBe, anti-HBe antibodies, retroviral serology, anti-HCV antibodies, serum transaminase levels, alpha-fetoprotein, complete blood count, serum creatinine, HBV DNA testing, ultrasound examination, and FibroScan. Notably, alpha-fetoprotein levels were measured in select patients. Based on their profiles, two categories of patients were identified: those with inactive chronic infection and those with active chronic infection.

For the first group with chronic inactive HBV infection, follow-up appointments are scheduled biannually. Viral load assessments, abdominal ultrasounds, and Fibroscans are performed at least once a year. Transaminase levels and complete blood counts are checked at least twice a year. For patients with active chronic infection who have started treatment, the following monitoring schedule is implemented:

Month 1 (M1): Transaminases, creatinine, blood count, and phosphoremia are reviewed. Month 3 (M3): Blood count and transaminases are assessed. Month 6 or 9 (M6 or M9): Blood count, transaminases, ultrasound, and HBV DNA test are performed. If there are no issues, and patient compliance is satisfactory, they are seen at Month 12 (M12) for DNA testing, blood count, transaminases, and abdominal ultrasound.

Table 3. Distribution of patients according to HBV viral load during biological monitoring.

Biological monitoring of chronic hepatitis B	N	Percentage
First Biological Monitoring		
Viral DNA (IU/mL) (n = 260)		
Undetectable viral load	0	0
<20,000	196	75.38
[20,000 - 200,000]	20	7.69
>200,000	44	16.93
Second biological monitoring		
Viral DNA (IU/mL) (n = 260)		
Undetectable viral load	3	1.15
<20,000	237	91.16
[20,000 - 200,000]	12	4.62
>200,000	8	3.07
Third biological monitoring		
Viral DNA (IU/mL) (n = 260)		
Undetectable viral load	2	0.77
<20,000	240	92.31
[20,000 - 200,000]	8	3.08
>200,000	10	3.84
Fourth Biological Monitoring		
Viral DNA (IU/mL) (n = 260)		
Undetectable viral load	2	0.77
<20,000	234	90.00
[20,000 - 200,000]	16	6.15
>200,000	8	3.08
Fifth biological monitoring		
Viral DNA (IU/mL) (n = 260)		
Undetectable viral load	3	1.15
<20,000	237	91.16
[20,000 - 200,000]	20	7.69
>200,000	0	0
Sixth biological monitoring		
Viral DNA (IU/mL) (n = 260)		
Undetectable viral load	3	1.15

Continued

<20,000	202	77.70
[20,000 - 200,000]	37	14.23
>200,000	18	6.92
Seventh biological monitoring		
Viral DNA (IU/mL) (n = 260)		
Undetectable viral load	5	1.92
<20,000	180	69.23
[20,000 - 200,000]	75	28.85
>200,000	0	0

For compliant patients, subsequent follow-up appointments are scheduled biannually, including viral load assessment, ultrasound examination, and FibroScan at least once a year. Additionally, blood counts, serum creatinine, serum phosphorus, and transaminase levels are checked twice a year. Some patients may also undergo computed tomography (CT) scans and esophagogastroduodenoscopy (EGD) as needed.

During the first follow-up, no cases of undetectable viral load were observed. At the second follow-up, three (3) patients had an undetectable viral load (1.15%), and eight (8) patients had a viral load greater than 200,000 IU/mL (3.07%). Twenty-five (25) patients had an AST level above 40 IU/L (10.28%), forty (40) patients had an AST level above 35 IU/L (16.46%), and two (2) patients had an alpha-fetoprotein level greater than 10 ng/mL (18.18%).

During the third follow-up, two (02) patients had an undetectable viral load (0.77%), and ten (10) patients had a viral load greater than 200,000 IU/mL (3.84%). Eleven (11) patients had an AST level greater than 40 IU/L (5.64%), twenty-eight (28) patients had an AST level greater than 35 IU/L (14.36%), and one (1) patient had an alpha-fetoprotein level greater than 10 ng/mL (3.44%).

At the fourth follow-up, two (02) patients had an undetectable viral load (0.77%), and eight (08) patients had a viral load greater than 200,000 IU/mL (3.08%). Eleven (11) patients had an AST level above 40 IU/L (8.20%), twenty-nine (29) patients had an AST level above 35 IU/L (21.64%), and two (2) patients had an alpha-fetoprotein level greater than 10 ng/mL (13.33%).

During the fifth and sixth follow-ups, three (03) patients each had an undetectable viral load (1.15%). At the seventh follow-up, five (05) patients had an undetectable viral load (1.92%). In total, eighteen (18) cases of undetectable viral load (6.92%) were observed. The evolution of the average HBV viral load is depicted in Figure 1.

Ultrasound examinations conducted before treatment revealed thirty-four (34) cases of hepatomegaly (13.08%), sixteen (16) cases of liver with a heterogeneous structure (6.15%), and eight (08) cases of irregular liver contours (3.08%) (Table 4). Subsequent ultrasounds conducted after treatment identified thirty

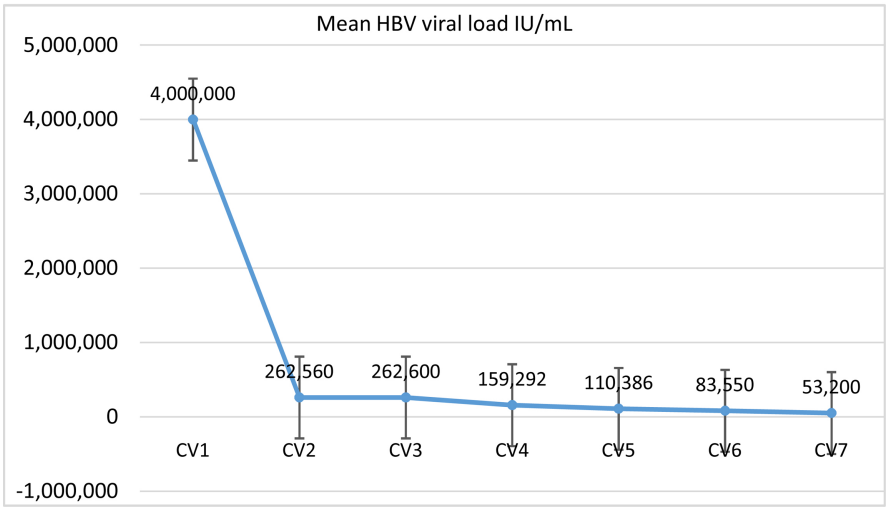

Figure 1. Evolution of mean HBV viral load during follow-up.

Table 4. Distribution of patients according to liver characteristics before and after treatment.

	Before treatment		*After treatment*		p-value
Characteristics of the liver	**N**	**%**	**N**	**%**	
Size (n = 260)					
Normal	226	86.92	230	88.46	0.620
Hepatomegaly	34	13.08	30	11.54	0.861
Structure (n = 260)					
Homogeneous	244	93.85	260	100	<0.001
Heterogeneous	16	6.15	0	0.00	-
Outlines (n = 260)					
Regular	252	96.92	260	100	0.011
Irregular	8	3.08	0	0.00	-

(30) cases of hepatomegaly (11.54%). Notably, the liver's homogeneous structure ($p < 0.001$) and regular contour ($p = 0.011$) showed significant associations with the treatment (Table 4).

FibroScan® results were obtained for two hundred and thirty-three (233/260) patients, accounting for 89.62% of the study cohort. Stage F3-F4 fibrosis was detected in five (05/233) patients, corresponding to 2.14% of the cases. Steatosis was observed in fifteen (15/233) patients, representing 6.44% of the cohort, with two (02/15) cases classified as S3 (13.33%). Furthermore, four (04/233) cases of stage F3-F4 fibrosis (17.16%) were observed in patients with a viral load exceeding 200,000 IU/mL, while eleven (11/260) cases of hepatomegaly (42.30%) were noted in individuals with a viral load below 20,000 IU/mL.

3.4. Therapeutic Aspects

Tenofovir-based medical treatment was administered to 226 patients with chronic viral hepatitis B. The prescribed dosage consisted of one Tenofovir 300 mg tablet taken once daily as a lifelong treatment. The treatment was consistently followed by 222 out of 226 patients (98.23%), while four (4) patients (1.77%) exhibited irregular adherence. The causes of non-compliance were varied, including abandonment of the treatment due to its lifelong nature, opting for traditional decoctions, and facing challenges in obtaining regular supplies (such as costs and distance from the Central Purchasing Center for Essential Generic Medicines (CAMEG)).

4. Discussion

In the present study, patients with chronic viral hepatitis B were predominantly young, with a mean age of 31.41 ± 8.56 years (ranging from 7 to 75 years). These findings are consistent with the existing literature. Sombié *et al.* [5] in 2010 in Burkina Faso, Diallo *et al.* [9] in 2018 in Senegal, Benyahia *et al.* [10] in 2020 in Algeria, and Toumin *et al.* [11] in 2021 in 2021 in Côte d'Ivoire reported a mean age of 32 years, 33 years, 43 years, and 45 years, respectively, in their respective studies. Notably, the age group between 21 and 30 years old was the most affected, constituting 48.08% of cases. Cumulative frequency calculations revealed that more than 50% of our patients were below 50 years of age. Similar results were found by Diallo *et al.* [9] in their study. These results from our study may be attributed to the fact that Burkina Faso is characterized by a predominantly youthful population, as evidenced by the preliminary results of the 5th General Census of Population and Housing (RGPH) [12] in 2019, which reported that the proportion of the active population (aged 15 - 64 years) is 51.3%. Additionally, the high prevalence of HBsAg carriage among young individuals could also be linked to factors such as low awareness of HBV infection, early sexual activity, lifestyle choices, and low HBV vaccination coverage [13].

In our series, hepatitis B primarily affects women, demonstrating a female predominance of 53.08%. This finding contrasts with the literature, which often reports a male predominance. For instance, studies by Sombié *et al.* [5] in Burkina Faso (66.9%), Toumin *et al.* [11] in Côte d'Ivoire (71%), and Brahimi *et al.* [14] in Algeria in 2021 (65.4%) observed a higher prevalence in men. These discordant results may be attributed to the fact that, in our context, women tend to seek medical consultation more frequently than men. Furthermore, our study included several patients who were referred by the maternity ward for follow-up, potentially skewing the gender distribution. Additionally, the preliminary results of the 5th General Population and Housing Census (RGPH) in Burkina Faso, conducted in 2019, indicated that women constitute most of the population (51.7%).

The most prevalent professional group consisted of civil servants, comprising 38.08% of cases. This observation aligns with the findings of Toumin *et al.* [11]

who reported a proportion of 38.9%. The higher prevalence among civil servants could be attributed to their exposure to certain risk factors, particularly engaging with sex workers and having multiple sexual partners without adequate protective measures. Civil servants are often required to work in various public administration roles across the country, resulting in significant mobility within this group. At times, they may live far from their families, rendering them vulnerable to specific risk factors. In our series, 73.46% of patients resided in urban areas. A similar trend was noted by Touré *et al.* [15] in their 2017 study in Senegal, where 76.5% of cases were urban residents. While the preliminary results of the 5th General Population and Housing Census (RGPH) in Burkina Faso conducted in 2019 [12] indicated that the majority of Burkina Faso's population resides in rural areas (73.7%), our findings can be explained by the fact that Saint Camille Hospital in Ouagadougou is located in the capital city of Ouagadougou, which has a predominantly urban population.

Married individuals were the most affected group in our study, constituting 52.69% of cases. This finding is consistent with the results of Toumin *et al.* [11] in Côte d'Ivoire, who reported a prevalence of 62.5%. The predominance of affected married couples can be attributed, in part, to routine screening practices that occur during prenuptial assessments or when a spouse undergoes screening when entering a marriage, especially when the entry point is through a pregnant woman (systematic screening among pregnant women).

The habits and lifestyle of the study participants were characterized by alcohol consumption in 3.08% of cases and tobacco use in 2.69% of cases. Identified risk factors for HBV transmission included a family history of viral hepatitis B infection (68.0%), engagement in high-risk professions (28.0%), and a history of high-risk transfusions (4.0%). In a study conducted by Toumin *et al.* [11], sexual risk factors were observed in 32.8% of their participants. This finding can be attributed to the fact that a significant proportion of chronic HBV infections occur during the perinatal and postnatal periods. Certain risky behaviors, such as sex work and the manipulation of biological fluids, increase the likelihood of HBV transmission.

During our study, we identified one case of HBV and HIV type 1 co-infection, representing 0.38% of the total cases. This finding is consistent with the results reported by Kpossou *et al.* [16] in 2019 in Benin, who also detected one case of co-infection, accounting for 0.3%. These findings underscore the rarity but not insignificance of HIV-HBV co-infection. Consequently, there is a compelling need for systematic screening for HBV in all HIV-infected patients to facilitate comprehensive healthcare. In contrast, Keita *et al.* [17] in 2014 in Guinea-Conakry identified 26 cases of HIV-HBV co-infection in their study, including 11 cases of co-infection involving HIV and chronic viral hepatitis B. The disparity in results between our study and that of Keita *et al.* may be attributed to differences in study focus. Our study specifically concentrated on patients with chronic viral hepatitis B, while Keita *et al.* [17] focused on HIV-positive cases,

which could encompass a broader spectrum of individuals.

All the patients in our series had an average consultation duration of less than one year between follow-ups and underwent viral load assessments every six months to one year. During the first follow-up after initiating treatment, none of the patients had an undetectable viral load, with 16.93% (44 cases) having a viral load > 200,000 IU/ml, and 31.25% showing elevated transaminase levels. Subsequently, from the second to the seventh follow-up visits, an undetectable viral load was observed in 6.92% (18/260) of cases. This rate is significantly lower compared to the findings of Sombié *et al.* [5] who reported an undetectable viral load in 69 out of 77 cases, equivalent to 89.6%. The lower rate observed in our study could be attributed to differences in the study type, sample sizes, and study context. Sombié *et al.* conducted an observational study with consecutive recruitment of 77 patients aged over 15, all of whom were chronic carriers of the B virus and had received treatment for at least one year.

At the first follow-up check-up, forty-four (44) patients had a viral load > 200,000 IU/ml, accounting for 16.93% of cases. Interestingly, at the last check-up, there were no recorded cases of viral load exceeding this threshold. This contrasts with the findings of Bivigou-Mboumba *et al.* [18] in 2017 in Gabon, where viral load remained detectable throughout their study period due to HIV-1 co-infection among their study population. Additionally, there was a reduction in transaminase levels. Initially, 80 cases (31.25%) exhibited high transaminase levels, which subsequently decreased to 40 cases or 29.84%.

These results obtained during our study would reflect, among other things, the immunological control of the infection, the therapeutic observance by our patients and the effectiveness of the treatment instituted. In addition, the natural history of chronic hepatitis B is characterized by repeated phases of immune tolerance, attempted immune clearance, and inactive carriage [5]. This phase is characterized by the decrease or normality of transaminases over several successive examinations, a decrease in viral DNA below 2000 IU/ml [5]. The evolution of the viral load observed in our series could be attributed to the case of therapeutic non-compliance, to the case of HIV-HBV co-infection and to the asymptomatic nature of the disease, which makes virological control difficult.

In this study, FibroScan® was performed in 89.62% of our patients. In the work of Berthe *et al.* [19] in Senegal in 2015 and Toumin *et al.* [11] in Côte d'Ivoire in 2021, FibroScan® was conducted for all their patients. However, the high cost associated with this examination may have limited its widespread use in all our patients. Among the patients who underwent FibroScan® in our series, results revealed severe F3-F4 hepatic impairment in 5 patients, constituting 2.14% of cases. It's possible that this result is indicative of a late diagnosis of the condition. It's worth noting that our result may be underestimated due to the inability to perform FibroScan® in some of our patients, primarily due to limited accessibility. Similar observations were made by Toumin *et al.* [11], Benyahia *et al.* [10] and Touré *et al.* [15] in their studies, although at different rates, with proportions of 38.9%, 22%, and 10.9%, respectively.

Therapeutically, medical treatment relied on Tenofovir (TDF) 300 mg. The utilization of nucleoside analogues represents a significant advancement in the treatment of chronic hepatitis B. These compounds exhibit superior antiviral efficacy compared to interferon, offer a more favorable tolerance profile, and can be administered orally [20]. Five nucleoside or nucleotide analogues have been approved for the treatment of chronic hepatitis B, including Tenofovir, which inhibits HBV polymerase [20]. Tenofovir is often employed as the initial treatment for patients with chronic HBV, yielding favorable virologic response rates [13]. Indeed, Apendi *et al*. [13] in 2020 in Congo Brazzaville reported an undetectable viral load in 74.7% of their study population with Tenofovir-based treatment. A similar observation was made by Sombié *et al*. [20] in 2015, where an undetectable viral load was achieved in 89.6% of cases. In 2010, in their study on the epidemiological, diagnostic, therapeutic, and evolutionary aspects of chronic viral hepatitis B, Sombié *et al*. [5] found Tenofovir, combined with Lamivudine, to be effective in patients with detectable HBV-DNA but less than 600 IU/ml after two years of treatment, as well as in patients who developed resistance to Lamivudine. Furthermore, the World Health Organization (WHO) recommends the prescription of Tenofovir for oral hepatitis B treatment [2] because, despite the indefinite duration of the treatment, this molecule remains available in our pharmacies at a low or reduced cost in our country.

It should be noted that this study, like any retrospective data collection study, had a number of limitations, such as the incompleteness of the medical records and the fact that not all patients were able to complete the paraclinical examinations. Nevertheless, it provided interesting results that allowed us to study the dynamics of HBV viral load during the follow-up of patients with chronic hepatitis B at the Saint Camille Hospital in Ouagadougou.

5. Conclusion

Viral hepatitis B is a fairly common condition in hepato-gastroenterology consultations. This study has demonstrated that well-conducted medical treatment with regular monitoring can yield positive outcomes. Therefore, it is crucial to emphasize the quantification of viral load during follow-up appointments to tailor the care of patients living with HBV and prevent complications.

Conflicts of Interest

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

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