



Serological Profile of Hepatitis B Virus at Ibn Rochd University Hospital Center (Casablanca, Morocco)

Farmati Asmaa^{a,b*}, Houar Souad^{a,b},
Drissi Bourhanbour Asmaa^{a,b,c} and El-Bakkouri Jalila^{a,b,c}

^a Laboratory of Sero-immunology, Ibn Rochd University Hospital Center, Casablanca, Morocco.

^b Faculty of Medicine and Pharmacy, Hassan II University, Casablanca, Morocco.

^c Laboratory of Clinical Immunology and Immuno-Allergy, Casablanca, Morocco.

Authors' contributions

This work was carried out in collaboration among all authors. Author FA designed the study, performed the statistical analysis and wrote the protocol. Authors FA and HS managed the literature searches and wrote the first draft of the manuscript. Authors DBA and EBJ supervised the whole study which. All authors read and approved the final manuscript.

Article Information

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/99278>

Original Research Article

Received: 24/02/2023

Accepted: 29/04/2023

Published: 05/05/2023

ABSTRACT

Aim: Hepatitis B virus (HBV) infection is a major public health problem with complications of progression to cirrhosis and hepatocellular carcinoma. In Morocco, the real extent of the problem related to these infections in the general population is not precisely known.

The objective of our study is to determine the serological profile of hepatitis B in patients referred to the sero-immunology laboratory of Ibn Rochd University Hospital Center in Casablanca.

Study Design: Retrospective study.

Place and Duration of Study: Sero-immunology laboratory at Ibn Rochd University Hospital Center, between January 1st, 2020 to December 31st, 2022.

Methodology: This is a study based on the exploitation of data from the computer system including the results of serum analyses of HBs antigen (HBsAg), HBc antibody (HBcAb) and HBs

*Corresponding author: E-mail: asmaa.farmati@gmail.com;

antibody (HBsAb). The various assays were performed using the chemiluminescence technique on the Architect i1000 Analyser.

Results: Out of 4717 tests collected, 2487 patients (52.70%) were female and 2230 were male (47.30%). Ninety persons were HBsAg positive (1.90%), 846 persons were HBcAb positive (17.91%), 1290 persons were HBsAb positive (27.22%). The distribution of the positivity and negativity of the 3 associated markers showed 3153 persons with all 3 markers negative (67%), 708 persons with only HBsAb positive (15%), 578 persons with HBsAb as well as HBcAb positive (12.14%), 185 persons with only HBcAb positive (4%) and 90 persons with both HBsAg and HBcAb positive (1.90%).

Conclusion: The prevalence of Hepatitis B in our study population is low and 66.79% remain free of contact with the virus and require vaccination to avoid serious complications of HBV infection.

Keywords: Hepatitis B virus; HBsAg; HBsAb; HBcAb; vaccination.

1. INTRODUCTION

"Hepatitis B virus (HBV) infection is a major public health problem. In 2015, World Health Organization (WHO) estimated that two billion people worldwide have been infected with HBV, of whom 350 million are chronic carriers, and with nearly one million deaths each year" [1,2]. "The risk of developing major complications such as cirrhosis and hepatocellular carcinoma is estimated to be between 20% and 30% in people with chronic viral hepatitis B" [3]. "The highest concentrations of the virus are found in blood and oozing lesions, while moderate concentrations are found in semen and vaginal secretions and the lowest concentration is found in saliva" [4]. "The modes of transmission of Hepatitis B virus are therefore vertical (perinatal) and horizontal (sexual, blood, non-sexual intrafamilial)" [5,6].

HBV infection is widely distributed worldwide, and the incidence and prevalence of this disease are mainly related to socio-economic development. The prevalence of HBV is therefore 5.4% worldwide [7].

Based on the prevalence of HBs antigen (HBsAg), three geographical areas are delineated [8,9]. A distinction is made between:

- High endemicity areas correspond to a prevalence of HBsAg above 8%.
- Intermediate endemicity areas where HBsAg prevalence is between 2 and 8%.
- Low endemicity areas where HBsAg prevalence is less than 2%.

Thus, in HBV infection, several serological markers are expressed and have clinical

relevance. These markers are also of great interest for epidemiological studies. Indeed, HBV serological markers discriminate between acute and chronic infections and are used as serological evidence to assess the immune status of the host.

The main serological markers used in the evaluation of HBV infection are:

- Hepatitis B surface antigen (HBsAg),
- Antibody to hepatitis surface antigen (HBsAb),
- Total antibodies to hepatitis B core antigen (HBcAb)

Some studies have also introduced other markers such as "e" antigen (HBeAg) and antibodies against "e" antigen (HBeAb).

"These markers, in combination, provide HBV serological profiles that could better complement clinical assessment for better management of this infection. More recently, with the introduction of molecular assays in global infectious disease surveillance, HBV infection is assessed by quantitative HBV DNA" [10].

In Morocco, the epidemiology of viral hepatitis is not precisely well known. Few studies have been done to estimate the prevalence of HBV in the general Moroccan population. For this reason, the objective of our study is to evaluate the serological profile of hepatitis B in patients referred to the sero-immunology laboratory of Ibn Rochd University Hospital Center in Casablanca and to estimate the prevalence of the different serological markers for a better management of this infection and related diseases in Morocco.

2. MATERIALS AND METHODS

This is a three-year retrospective study from January 1st, 2020 to December 31st, 2022.

2.1 Study Population

During this period, the sero-immunology laboratory of Ibn Rochd University Hospital Center in Casablanca received 4714 requests containing the determination of the 3 markers, namely HBsAg, HBsAb and HbCAb in outpatients coming from the reception and sampling center and hospitalised patients in order to screen them for the serological profile of Hepatitis B. Blood samples were collected in dry tubes and centrifuged at 4000 rpm for 15 minutes.

2.2 HBV Serological Tests

The HBV serological markers, namely, HBsAb and HbCAb, were detected by chemiluminescence technique on the Architect i1000 Analyser. This technique is based on the labelling of antibodies with chemiluminescent compounds, i.e. compounds capable of producing light in the presence of a given reagent. The most commonly used markers are acridinium and ruthenium esters. In practice, magnetic beads coated with the specific antigen or antibodies are incubated with the patient serum. Labelled monoclonal antibodies are then added to the reaction medium. The cups containing the reaction are then exposed to a magnetic field which will detach the magnetic beads. The solution is then alkalised, which induces the emission of light from the chemiluminescent compound. The light measured is proportional to the concentration of the markers to be measured in the solution.

Results are expressed in international units per milliliter for HBsAb and signal-to-cutoff ratio [S/Co] for other markers. An HBsAb level of 10 IU/L was considered protective. An S/CO ratio ≥ 1 was considered positive.

3. RESULTS AND DISCUSSION

3.1 Results

3.1.1 Characteristics of the study population

Among the 4714 patients with the 3 markers, 47.30% were male and 52.70% were female with M/F sex ratio of 0.89. Ninety patients were found to be HBsAg positive, i.e. an overall prevalence of hepatitis B of 1.90%; 76.50% of the positive cases were inpatients and 23.50% were outpatients from the reception and sampling center.

3.1.2 Prevalence of HBsAg, HBsAb and HbCAb

Among the 4714 patients, 90 patients were HBsAg positive, i.e. 1.90% of the cases. HBsAb was detected in 1290 patients i.e. 27.22% and HbCAb in 846 patients i.e. 17.91%.

Thus, we classified our population into 5 categories: Unaffected, protected vaccinated, protected with former contact, isolated HbCAb and infection in progress (Table 1).

3.2 Discussion

Despite major efforts to control HBV infection, Hepatitis remains a major health problem in Morocco.

The objective of this study is to evaluate the serological profile of Hepatitis B in patients referred to the sero-immunology laboratory of Ibn Rochd University Hospital Center in Casablanca and to estimate the prevalence of different serological markers in this population. This approach is very important because the evaluation of the prevalence of HBV makes it possible to follow the evolution of the virus on a national scale and also to delimit the propagation of the infection by the measures of hygiene and protection.

Table 1. Prevalence of serostatus in all patients

Ag HBs	Markers		Status	Number	Prevalence
	Ac HbC	Ac HBs			
-	-	-	Unaffected	2961	67%
-	-	+	Protected, vaccinated	669	15,00%
-	+	+	Protected, former contact	539	12,15%
-	+	-	AcHbCisolated	179	4,00%
+	+	-	Infectionin progress	76	1,71%
+	-	-		6	0,13%
+	+	+		3	0,06%

Table 2. Prevalence of serostatus according to gender

Status		Male	Female
Unaffected	n	1476	1677
	%	46.80%	53.20%
Protected, vaccinated	n	309	399
	%	43.64%	56.36%
Protected, former contact	n	294	284
	%	50.85%	49.15%
AcHBcisolated	n	89	96
	%	48%	52%
Infection in progress	n	53	26
	%	67%	33%
	n	5	2
	%	71.42%	28.58%

Of the 4714 serum collected, 90 were found to be positive. These results show that Morocco is a low endemic country with an estimated HBsAg prevalence of 1.90%. This prevalence, less than 2%, is consistent with that found in other previous studies conducted in Morocco on the general population and which reported a prevalence of HBV <2%: 1.66% among the active population in the study conducted by Sbai. A et al in 2012 [11]; 1.81% in the cross-sectional survey as part of the large Hepatitis B and C screening program conducted by the Pasteur Institute of Morocco [12]. Other studies conducted on blood donors in Rabat in 2013 and 2016 reported a prevalence of 0.80 and 1.34%, respectively [13,14]. It should be noted that there is a slight difference in HBsAg prevalence between our study and the study conducted at Ibn sina hospital in Rabat, which found a prevalence of 2.47% [15] which is in line with the overall prevalence estimated at 3.3% by WHO in the Eastern Mediterranean Region. This HBV seroprevalence supports the classification of Morocco as a medium endemic area with a prevalence between 2 and 8% [16-17]. However, this prevalence is low compared to other neighbouring countries, notably Algeria (3.6%), Tunisia (4 to 7%) [12], Mali (11.1%), and Senegal (14.2%) [18].

This low seroprevalence of Hepatitis B could be explained by the different strategies undertaken by Morocco such as information and awareness campaigns against sexually transmitted infections, as well as the improvement of sanitary and socio-economic conditions and especially the introduction of the Hepatitis B vaccine in the expanded national vaccination program. Not to mention the medical coverage system and the epidemiological surveillance system that is being

set up for epidemic Hepatitis. HBV is a notifiable disease in Morocco.

The study of the prevalence of HBsAg according to sex showed a slight male predominance. These results are in agreement with the data [14]. This male predominance is thought to be related to higher exposure to HBV risk factors in men such as risky sexual behaviour or the use of multiple-use glass needles among drug users, which are the most important transmission factors. Other hormonal factors may contribute to women clearing HBV more efficiently than men [11].

“Overall, only 27.22% of patients were positive for HBsAb. This antibody screening is performed to monitor the course of Hepatitis B to check HBsAg/HBsAb seroconversion status, but also to assess the effectiveness of HBV vaccination. This value remains very low considering the development achieved in Morocco in terms of vaccination coverage since 1999” [19]. As a result, a significant proportion of the patients recruited for this study are at high risk of contracting HBV because they are likely to receive massive and/or iterative transfusions (haemophiliacs, dialysis patients, renal failure patients, organ transplant candidates), in psychiatric institutions, hospitalised patients, etc. The double burden due to HBV superinfection could be fatal for these vulnerable patients. Vaccination therefore remains the cornerstone of the fight against this virus.

In Morocco, vaccination coverage of children against HBV was introduced in 1999. Vaccination coverage for children under 1 year of age rose from 33% in 2000 to 93% in 2005 [19] and according to the national seroprevalence survey of viral hepatitis 2019 conducted by the Ministry

of Health, vaccination was carried out in 99.7% of cases in the public sector, 97% of participants aged between 5 and 18 years had received at least one dose of HBV vaccine and 91% had received 3 doses [20].

Currently, the vaccination coverage rate exceeds the global target of 90% and was 99% in 2021. Vaccination at birth (within the first 24 hours) against HBV was introduced in 2004 in Morocco with a coverage percentage reaching 64% in 2020 [21].

In the study population, total HBcAb were found in 17.91% of patients. These antibody compounds are IgM HBcAb and IgG HBcAb, which are widely reported as a good indicator of HBV endemic status.

In Moroccan National Seroprevalence Survey of Viral Hepatitis 2019, HBc Ab, was positive in 1189 patients out of a total of 11996 patients, giving an overall seroprevalence of 10.3% [20]. A lower prevalence of HBcAb was found in countries such as Iran, France and Spain (4.9%, 7.3% and 8.2%, respectively) [22,23]. "In contrast, a higher prevalence was found in countries such as Nigeria, Togo and Mauritania (32%, 53.9% and 76.5%, respectively)" [24,25].

The evaluation of HBsAg, HBsAb and total HBcAb serological markers is of great interest in the management of hepatitis B, as they allow the identification of the different phases of HBV infection and the follow-up of infected patients. The other virological markers, namely IgM HBcAb, HBeAg, HBeAb and molecular quantification of HBV DNA, are widely used but depend on the initial results of the first 3 markers. In the end, and according to the results obtained, the patients had 5 distinct serological profiles: Unaffected, protected vaccinated, protected with former contact, isolated HBcAb and infection in progress.

4. CONCLUSION

This study clearly demonstrated a low prevalence of HBV in Morocco and a very low HBV vaccination coverage. HBV infection remains a public health problem and new recommendations, in accordance with WHO guidelines, should be established to promote serology testing and strengthen the vaccination protocol to limit viral dissemination and ensure better management of this disease in Morocco.

CONSENT

As per international standard or university standard, patient (s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Muszlak M, Lartigau-Roussin C, Farthouat L, et al. Vaccination of children against hepatitis B in Mayotte, French island of Comoros. *Arch Pediatr* 2007;14:1132–6. French
2. Pierre Tiollais M, Chen Zhu M. The hepatitis B. *Pathol Biol.* 2010;58:243–4.
3. World Health Organization, Guidelines for the prevention, care and treatment of persons with chronic hepatitis B infection; 2015. Available: <https://www.who.int/publications/item/9789241549059> Accessed February 28, 2020.
4. WHO Geneva. Introduction of hepatitis B vaccine in childhood immunization services. WHO; 2002. English Available: <http://www.who.int/vaccines-documents/> Accessed May 2, 2020.
5. Michel ML, Tiollais P. Hepatitis B vaccines: Protective efficacy and therapeutic potential. *Pathol Biol.* 2010;58:288–95.
6. Alter Miriam J. Epidemiology of viral hepatitis and HIV co-infection. *J Hepatol* 2006;44:6–9.
7. Bristol-Myers S. Hepatitis B: Knowing it better to treat it better. *J Pediatr Pueric* 2006;19:340–3. French
8. Hou J, Liu Z, Gu F. Epidemiology and prevention of hepatitis B virus infection. *Int J Med Sci.* 2005;2:50–7.
9. Read JS, Cannon MJ, Stanberry LR, Schuval S. Prevention of mother-to-child transmission of viral infections. *Curr Probl Pediatr Adolesc Health Care.* 2008;38: 274–97.

10. Pawlotsky J-M. Virological techniques for the diagnosis and monitoring of hepatitis B. *Clinical and Biological Gastroenterology*. 2008;32(1):S56–63. French
11. Sbai A, Baha W, Ougabrai H, Allalia T, Dersi N, Lazaar F, et al. Prevalence of hepatitis B virus infection and assessment of risk factors in Morocco. *Pathology Biology*. 2012;60(5):e65–9. French
12. Baha W, Foulous A, Dersi N, They-they TP, El alaoui K, Nourichafi N, et al. Prevalence and risk factors of hepatitis B and C virus infections among the general population and blood donors in Morocco. *BMC Public Health*. 2013;13(1):50–8.
13. Adouani B, Alami R, Laouina A, et al. Hepatitis B in the population of blood donors in Morocco: comparison of the prevalence of HBsAg in the different categories of donors. *Transfus Clin Biol*. 2013;3(20):305–6. French
14. Laouina A, Adouani B, Alami R, Prevalence of infectious markers transmissible by transfusion among blood donors at the CRTS in Rabat (Morocco). *Transfer Clin Biol*. 2016;23(4):309–10. French
15. Feindiria M, Prevalence of hepatitis B Virus infection markers among patients of the Ibn Sina University Hospital Center (Rabat, Morocco): *Intervirolgy*. 2022; 65(2):80–86.
16. Schweitzer A, Horn J, Mikolajczyk RT, Krause G, Ott JJ. Estimates of worldwide Prevalence of chronic hepatitis B virus infection: A systematic review of data published between 1965 and 2013. *Lancet*. 2015;386(10003):1546–55.
17. Ott JJ, Stevens GA, Groeger J, Wiersma ST. Global epidemiology of hepatitis B virus infection: new estimates of age-specific HBsAg seroprevalence and endemicity. *Vaccinated*. 2012;30(12): 2212–9.
18. Diop M. Prevalence of hepatitis B surface antigen and its associated factors in Senegalese military personnel sent on mission to Darfur. *Pan Afr. Med. J*. 2017; 26:154.
19. Barkat A, Braikat M, Lamdouar Bouazzaoui N. National Vaccination Schedule: Evolution and perspectives. *Santé Maghreb*; 2008. French Available:<http://www.abhatoo.net.ma/maal-ama-textuelle/developpement-economique-et-social/developpement-social/sante/sante-publique/calendrier-national-de-vaccination-evolution-et-perspectives> Accessed on March 02, 2022.
20. Moroccan Ministry of Health, National Viral Hepatitis Seroprevalence Survey; 2019. French Available:https://www.sante.gov.ma/Publications/Etudes_enquete/Documents/2022/Brochure_Etude-HV_VF.pdf Accessed April 28, 2020.
21. Ministry of Health and Social Protection of Morocco, National strategic plan for the fight against viral hepatitis, 2022-2026. French Available:<https://www.sante.gov.ma/Activites/Images/PLAN%20STRAT%C3%89GIQUE%20NATIONAL%20DE%20LUTTE%20CONTRE%20LES%20H%C3%89PATITES%20VIRALES%202022-2026.pdf> Accessed on January 15, 2023.
22. Karimi G, Zadsar M, Vafaei N, et al. Prevalence of antibody to Hepatitis B core antigen and Hepatitis B virus DNA in HBsAg negative healthy blood donors. *Virology*. 2016;13(1):36–6.
23. Cuadrado A, Perelló C, Cabezas J, Llerena S, et al. Update on epidemiology of hepatitis B in a low-endemic European country: there is still much to do. *J Viral Hepat*. 2020;27(11):1261–5.
24. Ogunfemi MK, Olawumi HO, Olokoba AB et al. Prevalence of antibody to hepatitis B core antigen among hepatitis B surface antigen-negative blood donors in Ilorin, Nigeria: A Cross Sectional Study. *Malawi Med J*. 2017;29(1):32–6.
25. Mansour W, Malick FZ, Sidiya et al. Prevalence, risk factors, and molecular epidemiology of hepatitis B and hepatitis delta virus in pregnant women and in patients in Mauritania. *J Med Virol*. 2012; 84(8):1186–98.

© 2023 Asmaa et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:

<https://www.sdiarticle5.com/review-history/99278>