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Original Article

High Vaccination Coverage against Hepatitis B Infection and Profile of Biomarkers of Infection in Children less than 60 Months of Age

Couverture vaccinale élevée contre l'hépatite B et profil des biomarqueurs de l'infection chez les enfants de moins de 60 mois

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Mots Clés: VHB, transmission mère-enfant, vaccination, immunoglobuline

ABSTRACT

Introduction. Mother-to-child transmission is a common route of Hepatitis B Virus (HBV) infection to infants, but maternal antiviral prophylaxis, and hepatitis B vaccination and immunoglobulin (HBIG) given to children born to HBsAg-positive mothers within the first 24 hours of life, may prevent vertical transmission. We sought to determine the frequency of Hepatitis B infection biomarkers and determinants of transmission in children aged less than 60 months. **Methods.** A cross-sectional study was conducted from January 2019 to April 2020 with 300 children < 60 months of age. A questionnaire was used to collect information and detection of the HBsAg, anti-HBs, anti-HBc, HBeAg and anti-HBe, was performed by rapid diagnostic test and ELISA. **Results.** two of the 300 children were positive for the HBsAg (0.7%) and the prevalence of anti-HBs, anti-HBe, anti-HBc and HBeAg were 77.7%, 0.7%, 7.5% and 0.9%, respectively. Two hundred and ninety one (97.12%) children had received at least three doses of hepatitis B vaccine compared to 11.7% of the mothers. On the other hand, 220 (73.25%) children who were vaccinated showed a profile suggestive of immunity against hepatitis B infection. Ten of the 12 children born of HBsAg-positive mothers (naïve to antiviral), received the hepatitis B vaccine and HBIG nd were uninfected, whilst the other two were infected. **Conclusion.** High hepatitis B vaccine coverage (97.12%) and low prevalence of the HBsAg (0.7%) were observed. Sensitization of pregnant women on vertical transmission and prevention of hepatitis B, and routine testing are key interventions in preventing vertical transmission of HBV.

RÉSUMÉ

Introduction. La transmission de la mère à l'enfant est une voie courante d'infection par le Virus de l'Hépatite B (VHB) chez les nourrissons. La prophylaxie antivirale maternelle, ainsi que la vaccination contre l'hépatite B et l'immunoglobuline (HBIG) administrés aux enfants nés de mères séropositives pour l'AgHBs dans les 24 premières heures de vie, pourraient prévenir cette transmission. Ainsi, nous avons décidé de déterminer la fréquence des biomarqueurs de l'infection par le VHB et les déterminants de la transmission chez les enfants âgés de moins de 60 mois. **Méthodes.** Une étude transversale a été menée de janvier 2019 à avril 2020 auprès de 300 enfants de moins de 60 mois. Un questionnaire a été utilisé pour recueillir des informations et la détection de l'AgHBs, l'anti-HBs, l'anti-HBc, l'AgHBe et l'anti-HBe, par un test rapide et ELISA. **Résultats.** Deux (0,7%) des 300 enfants étaient positifs pour l'AgHBs et la prévalence des anti-HBs, anti-HBe, anti-HBc et AgHBe était de 77,7%, 0,7%, 7,5% et 0,9%, respectivement. Deux cent quatre-vingt-onze (97,12 %) enfants avaient reçu au moins trois doses de vaccin contre l'hépatite B, contre 11,7 % des mères. En revanche, 220 (73,25 %) enfants vaccinés présentaient un profil suggérant une immunité contre l'infection par le VHB. Dix des 12 enfants nés de mères séropositives pour l'AgHBs (naïves aux antiviraux) ont reçu le vaccin contre l'hépatite B et l'HBIG n'étaient pas infectés, tandis que les deux autres l'étaient. **Conclusion.** Une couverture vaccinale élevée contre l'hépatite B (97,12%) et une faible prévalence de l'AgHBs (0,7%) ont été observées. La sensibilisation des femmes enceintes sur la prévention de l'hépatite B, ainsi que leurs dépistages, pourraient être essentielles pour prévenir la transmission verticale.

INTRODUCTION

Hepatitis B is caused by the Hepatitis B Virus (HBV) leading to inflammation and damage of the liver. This infection can be acute or chronic, exposing individuals to a high risk of death from liver cirrhosis and hepatocellular carcinoma. Within the WHO African Region, hepatitis B in the adult population is at 6.1%,

which makes it a major public health problem and a "silent killer in Africa" [1]. Meanwhile, in Cameroon, the seroprevalence is 11.9% among adults which implies that Cameroon is a highly endemic zone, and 6.4% to 7.7% among pregnant women in Yaoundé, the capital city of Cameroon [2,3]. Both latter studies showed a pattern of high infectivity and increased risk of mother-to-child transmission of HBV, with rates of vaccination against hepatitis B among these women of 2.7% and 2.5%, respectively. In one of the studies, 83.3% knew that HBV infection is vaccine preventable [3].

Vertical transmission is the most common route of transmission of HBV in many high-prevalence areas and may occur through 90% of mothers who are hepatitis B surface antigen (HBsAg)-positive and hepatitis B e antigen (HBeAg)-positive, and who do not take any prophylaxis [4]. Thus, 80% to 90% of infants infected during the first year of life and 30% to 50% of children infected before the age of 6 years, may develop chronic hepatitis B infection. Routine prenatal testing of women is therefore recommended, as well as hepatitis B antiviral for HBsAg-positive pregnant women. Coupled with this intervention to the mother, the hepatitis B vaccine and hepatitis B immune globulin are administered to the baby during 24 hours of life to prevent transmission from mother-to-newborn [5]. Of note, an effective programme of prevention of mother-to-child transmission (PMTCT) of HBV is being scaled-up in Cameroon.

With no accurate data on the rate of vertical transmission of HBV in Cameroon, we sought to study among children of age between 10 months and 60 months, the rate of HBsAg positivity, rates of vertical transmission and vaccination against hepatitis B in three paediatric centres and a Pre-School in the Centre Region of Cameroon. Such data would be useful in evaluating ongoing efforts and in designing a Prevention of Mother-to-Child Transmission (PMTCT) Programme of HBV, and integrate it into the successful ongoing PMTCT of HIV Programme.

MATERIALS AND METHODS

Ethics approval for this study was obtained from the Cameroon National Ethics Committee (N° 2019/05/17/CE/CNERSH/SP). From three hospitals and one Pre-School in the Centre Region of Cameroon, 300 children between 10 months and 60 months of age were screened for hepatitis B infection serologic markers from January 2019 to April 2020 following consent from parents or legal guardians. A questionnaire was used to collect demographic information from the mothers and children, as well as hepatitis B vaccination history and use of hepatitis B immune globulin.

Plasma was obtained and tested for HBsAg by a rapid test (ABON HBV Test) and confirmed by ELISA, while anti-HBc antibody, anti-HBs antibody, HBeAg and anti-HBe antibody titre were measured by ELISA (DIASORIN). Data is presented as proportions.

RESULTS

Of 300 children aged between 10 months to 60 months, 144 were female. The mothers were aged between 15 years and 46 years, with 87.57% within the age range of 21 years to 40 years. In general, 45% of the mothers earned a salary while 55% were housewives. Voluntary testing for HBV among the women was 5.23% while 11.76% had received the hepatitis B vaccine.

Hepatitis B vaccination coverage among women and children

Two hundred of the mothers (66.67%) were screened for HBsAg during pregnancy and 12 were carriers. Ten children of the 12 born of HBsAg-positive mothers were vaccinated against hepatitis B infection and also administered the HBIG (sero-vaccination), and were HBsAg-negative. Meanwhile, the 2 other children who did not receive the hepatitis B vaccine or sero-vaccination, were HBsAg-positive.

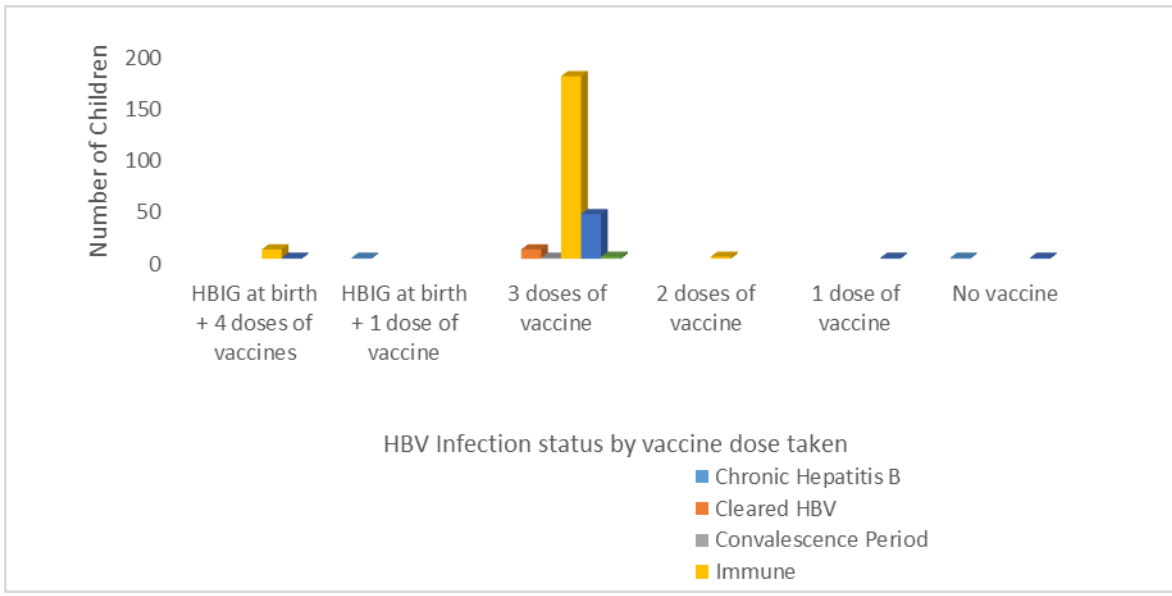

Figure 1: Number of Hepatitis B vaccine doses to the children and potential outcomes

Seroprevalence of HBV infection biomarkers and potential outcome among children

The rates of HBV infection biomarkers of the 300 children are shown in Figure 1. Two hundred and eighty one (93.79%) children received 3 doses of hepatitis B vaccine, while 10 (3.33%) whose mothers were HBsAg-positive received 4 doses. The rate of incomplete hepatitis vaccine coverage was 2.88%.Of 300 children involved in this study, 144 were female. Table 1 shows the seroprevalence of HBV infection markers of the children. Two (0.7%) children were HBsAg-positive while 230 (77.7%) had anti HBs antibodies.

On the other hand, 220 (73.25%) children who were vaccinated showed a profile suggestive of immunity against hepatitis B infection (immunity defined as HBsAg-, HBs+ antibody, HBc- antibody and HBe-antibody profile) (Figure 2).

DISCUSSION

In this study, we evaluated the profile of HBV infection markers in children less than 60 months of age. Of the three hundred children tested, 2 (0.7%) were HBsAg-positive but 77.7% of anti-HBs antibodies. The HBsAg seroprevalence is similar to that reported in 2015 by Bekondji et al. in Cameroon [6] although the study population was more representative than ours.

HBV vaccine was introduced into the Expanded Program on Immunization (EPI) in Cameroon in 2005. In our study, the number of Hepatitis B vaccine doses and HBIG administered to the children was estimated using the immunization card and maternal recall. The results showed that two hundred and eighty one (93.79%) children received 3 doses of hepatitis B vaccine, while 10 (3.33%) whose mothers were HBsAg-positive received 4 doses. The rate of incomplete hepatitis vaccine B coverage was 2.88%. Between 2009 and 2010, 4 years after the introduction of the Hepatitis B vaccine into the EPI, the studies carried out by Bekondi et al showed that 166 (93.78%) out of 177 children had received all 3 doses of vaccine using their vaccination cards. The results of a similar study conducted by Yasmile R and colleagues in 2016, showed that out of 150 children, 70% took all 3 doses of the hepatitis B vaccine [7]. From our study, we observed that the rate of complete vaccination against hepatitis B in children of 93.79%. In addition, 220 (73.25%) children who were vaccinated showed a profile suggestive of immunity against hepatitis B infection (immunity defined as HBsAg-, HBs+ antibody, HBc-antibody and HBe- antibody profile), compared to 281 who received at least 3 doses of the vaccine. This may imply that some of the children were poor responders or may have received dose(s) of poor quality. Overall, the level of hepatitis B vaccination coverage (of at least 3 complete doses) among children in Yaounde is high.

WHO recommends for the Prevention of Mother to Child Transmission (PMTCT) of HBV, that the HBsAg-positive pregnant woman with an HBV DNA load of ≥5.3 log10 (≥200,000 IU/mL) should receive tenofovir (TDF) prophylaxis from the 28th week of pregnancy, whilst the newborn should receive the first dose of hepatitis B vaccine as soon as possible (preferably within the 24 hours of life), and where possible the HBIG, followed by two or three doses of the vaccine to complete the primary series. [8]. Thus, the 2 children born to HBV-infected mothers who did not receive the vaccine and HBIG at birth, as well as subsequent doses, were infected, while the other 10 who received the 4 doses of the hepatitis B vaccine and HBIG, were protected. Hence the need for pregnant women to be tested for hepatitis B, and follow the PMTCT guidelines to save the lives of their children and contribute in the elimination of hepatitis B in the world by 2030.

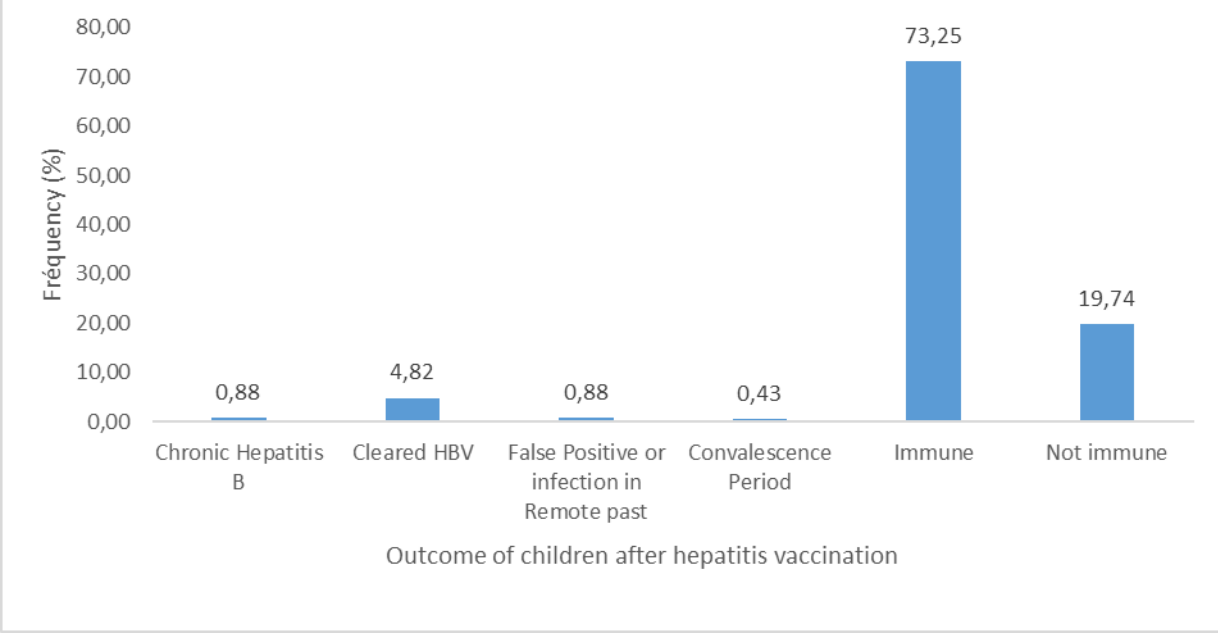

Figure 2: Potential outcome of children defined by the profile of serologic markers of HBV infection

Results of the distribution of mothers according to knowledge of their hepatitis B status showed that out of 300 mothers, 200 (66.67%) were aware of their HBsAg status and a majority were tested during pregnancy. Of these 200 mothers, only 22(11.76%) had received the hepatitis B vaccine. However, Hannachi et al (2009) in a study conducted in Tunisia among pregnant women showed that out of 96.8% of women who knew their HBV serological status, only 1.4% of these women had received the vaccine [9]. Likewise, Adeyemi et al, in a study conducted in Nigeria with aim to assess the knowledge on HBV infection, access to screening and vaccination in pregnant women, reported that of 19.5% of women who knew their status, only 9.7% took the vaccine [10]. However, reports from similar studies conducted in Yaoundé in Cameroon since 2010, indicate an increase in the rate of vaccination among pregnant women, although still low (as from this study of 11.76%). It is expected that with more sensitization of the population on the modes of transmission and prevention of hepatitis B, more women will attend antenatal clinics and get tested for HBV. Only 5,23% of these mothers volunteered to be tested for HBV. A high rate of vaccination against hepatitis B was reported in this study which may have resulted in the low rate of infection (0.7%) among children less than 60 months of age.

CONCLUSION

An effective PMTCT of HBV is feasible in Cameroon where HBsAg serologic tests, antiviral tenofovir (TDF), hepatitis B vaccine and hepatitis B immunolglobulin are available. But the mainstay remains testing of the pregnant woman for HBV infection and promoting a "Hepatitis B-free Future".

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REFERENCES

1- WHO [Internet]. Hepatitis B. WHO; 2020 [Cited July 2020]. Available on: https://www.who.int/en/news-room/fact-sheets/detail/hepatitis-b

2- Fomulu N, Morfaw F, Torimiro J, Nana P, Koh M and Takang W. Prevalence, correlates and pattern of Hepatitis B among antenatal clinic attenders in Yaounde-Cameroon: is perinatal transmission of HBV neglected in Cameroon? BMC Pregnancy and Childbirth 2013, 13:158. http://www.biomedcentral.com/1471-2393/13/158

3- Torimiro J, Nanfack A, Takang W, Keou C, Awum J, Njefi K, Agyingi K, Domkam I, Takou D, Moudourou S, Sosso S and Mbu R. Rates of HBV, HCV, HDV and HIV type 1 among pregnant women and HIV type 1 drug resistance-associated mutations in breastfeeding women on antiretroviral therapy. BMC Pregnancy Childbirth 18, 504 (2018). https://doi.org/10.1186/s12884-018-2120-7

4- Gentile I and Borgia G. Vertical transmission of hepatitis B virus: challenges and solutions. Int J Womens Health. 2014; 6: 605–611.

5- WHO [Internet]. Prevention of Mother-to-Child Transmission of Hepatitis B Virus Guidelines on Antiviral Prophylaxis in Pregnancy. WHO; 2020 [Cited July 2020]. Available on: https://www.who.int/publications/i/item/978-92-4-000270-8

6- Bekondi C, Zanchi R, Seck A, Garin B, Giles-Vernick T, Gody J, Bata P, Pondy A, Moyo S, Ba M, Ekobo C, Rousset D, Sire J, Maylin S, Chartier L, Njouom R and Vray M. HBV immunization and vaccine coverage among hospitalized children in Cameroon, Central African Republic and Senegal: a cross-sectional study. BMC Infect Dis 2015 ; 15 : 267.

7- Yasmile R [Internet]. Prévalence de l'hépatite virale B chez les enfants en âge préscolaire dans le district de santé de Maroua. Médecine interne, Université de Yaoundé I ;2016. Disponible sur : http://www.hsd-fmsb.org/index.php/hsd/thesis/view/491.

8- Prevention of mother-to-child transmission of hepatitis B virus: guidelines on antiviral prophylaxis in pregnancy. Policy brief. Geneva: World Health Organization; 2020. Licence: CC BY-NC-SA 3.0 IGO.

9- Hannachi N, Bahri O, Mhalla S, Marzouk M, Sadraoui A, Belguith A, Triki H, Boukadida J. Hépatite virale B chez les femmes enceintes tunisiennes : facteurs de risque et intérêt de l'étude de la réplication virale en cas d'antigène HBe négatif. Pathologie Biologie 2009, 57(3) : 43-47.

10- Adeyemi A, Enabor O, Ugwu I, Bello f, Olayemi O. Knowledge of hepatitis B virus infection, access to screening and vaccination among pregnant women in Ibadan, Nigeria. J Obstet Gynaecol 2013 ; 33(2) : 155-9.