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Chapter

Traveler's Infections: Overview of Hepatitis B Virus Infection

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Abstract

Hepatitis B virus (HBV) is a double-stranded circular DNA virus that infects the hepatocytes. HBV infection is considered as an important public health concern globally especially with one-third of the world's population been infected. Local and international migrants are one of those population at high risk of the infection. Many factors interplay in the acquisition of HBV such as purpose of travel, destination endemicity rate of the virus, time of stay of the traveler, inadequate prevention and control measures, among others, understanding the genotypes of HBV is critical in correlating the evolution of the virus and migration of humans and also treatment responses of infected population. The symptom of the virus ranges from fever to jaundice and to a liver cirrhosis and hepatocellular carcinoma (HCC). Transmission of HBV is commonly via horizontal route in developing regions and in the developed regions; transmission occur more often among adults that use injectable drugs and high-risk sexual behaviors. Therefore, the Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO) have recommended HBV screening and vaccination to all travelers without an HBV immunization history before traveling to endemic regions. This chapter gives an overview on HBV as a potential traveler's infection.

Keywords: hepatitis B virus, travelers, vaccination, genotypes, travel medicine

1. Introduction

Hepatitis B virus (HBV) is a partially double-stranded viral agent with a circular deoxyribose nucleic acid (DNA) that replicates by reverse transcription. HBV infection is a hepatocyte infection that is globally considered as a public health concern [1–3]. There are more than 2 billion persons infected with HBV living today worldwide with 260 million estimated to be chronically infected with the infection and having a carrier rate varying from 9 to 20% in Sub-Saharan Africa (SSA) [4–6]. Annually, there are close to 900,000 HBV-related deaths, mainly due to cirrhosis or hepatocellular carcinoma (HCC). The viral infection is the fourth most common vaccine preventable infection among travelers returning home ill after enteric fever, acute hepatitis A, and influenza [7, 8]. This viral agent can cause both acute and chronic infections. Many infected persons show no symptoms during the initial stage of the infection. Typically, the viral agent has an incubation period of 90 days (range, 60–150 days). The acute HBV infection that is acquired newly only shows symptoms rarely. Signs and symptoms of the viral infection differs with age; most children aged under 5 years old and newly infected immunosuppressed adults often show no symptoms, while about 30–50% of people that are more than 5 years of

age are usually symptomatic [7]. When present, the typical signs and symptoms of acute infection include malaise, fatigue, poor appetite, nausea, vomiting, abdominal pain, fever, dark urine, light color (clay-colored) stool, joint pain, and jaundice [8]. The overall case fatality ratio of acute infection due to HBV is approximately 1% [9]. People infected with HBV are susceptible to infection with hepatitis D virus; coinfection increases the risk of fulminant hepatitis and rapidly progressive liver disease [10]. Transmission of HBV is mainly through percutaneous or mucosal exposure to HBV-infected blood or bodily fluids including saliva or semen [2]. There are reports of transmission via sexual contact and contaminated medical equipment and through sharing of infected needles and injecting apparatus [11].

The prevalence of chronic HBV infection is ≥2%, such as in the western Pacific and African regions; expatriates, missionaries, and long-term development workers may be at increased risk for HBV infection in such countries [7, 8]. Serologic markers specific for the viral agent are necessary to diagnose HBV infection and for appropriate clinical management [12]. These markers can differentiate between acute, resolving, and chronic infections. Polymerase chain reaction (PCR) method can further be use to qualitatively or quantitatively detect the amount of HBV DNA in patients' specimen after checking the markers of the virus [13]. All travelers should be screened for HBV infection markers, so that they would not be at risk of acquiring the virus during their stay [7].

2. Aspects of HBV morphology

Hepatitis B virus belongs to the family of *Hepadnaviridae* in the genus *Orthohepadnavirus*, and it is known to have a very high transmissibility [14, 15]. It is a hepatotropic DNA virus which also includes duck hepatitis B virus (DHBV) and woodchuck hepatitis B virus (WHBV) [16]. HBV is partially double-stranded with a circular DNA that is composed of an outer envelope containing hepatitis B surface antigen (HBsAg) and an inner nucleocapsid consisting of hepatitis B envelope antigen (HBeAg) and hepatitis B core antigen (HBcAg) of approximately 3.2 kb, generated from an intermediate RNA through reverse transcription that encodes

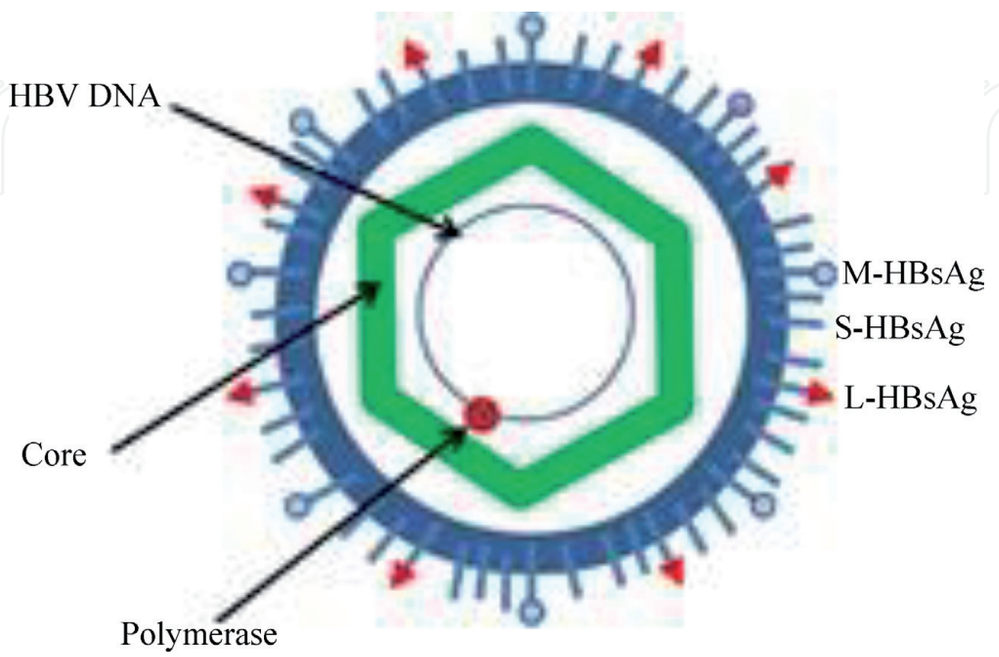

Figure 1.
Morphology of hepatitis B virus [16, 18].

four partially overlapping open reading frames (ORF): surface (S), encoding the viral surface protein; core (C) encoding core; polymerase protein; and pDNA and X genera as seen in **Figure 1** [17, 18]. The virus infects the liver of Hominoidae including humans and causes an inflammation called hepatitis. The disease was formally known as "serum hepatitis" [19].

3. How HBV replicates

The cardinal feature of HBV replication cycle is the replication of the DNA genome by reverse transcription, when virions bind susceptible cell-surface receptors and IgA receptors on liver cells following of RNA intermediate [18, 20]. The viral genome is transported into the nucleus, and it is then converted into a covalently closed circular double-stranded HBV DNA (cccDNA) molecule which acts as the transcriptional template for the host RNA polymerase II machinery that synthesizes polyadenylated and four capped mRNAs which encode the envelope structural proteins, viral core and the precore; polymerase; and X non-structural viral proteins [20]. A 3.5-kb genome length RNA is one of the major HBV transcripts which is translated to synthesize the viral core and polymerase proteins and also plays role as a pregenomic RNA that is encapsidated with the polymerase by the core protein in the cytoplasm of the liver cells. The replication of the viral agent usually happens entirely within these capsids by reverse transcription of the pregenomic RNA to synthesize a single-strand DNA copy that serves as the template for the second strand DNA produced, synthesizing a circular double-stranded DNA [21]. The viral capsids that contain the double-stranded DNA traffic either to the nucleus where amplification occurs or the viral cccDNA genome to stabilize intranuclear pool of transcriptional templates or to the endoplasmic reticulum, where they acquire the viral envelope proteins, bud into the lumen, and exit the cell as virions that can infect other cells [22, 23].

4. Pathogenesis and clinical features of HBV infection

Hepatitis B virus gets entry into the bloodstream and targets the liver cells [24]. The hepatocytes which are infected are distended, and the cytoplasm assumes a ground appearance that is glassy. The virus is not cytopathic, and injury of the liver in HBV chronic infection is due to immunological responses [8, 25]. Although, the virus has a long incubation period of 45–180 days, replication starts few days after infection. The infection can be acute, an unexpected sickness with a mild-to-severe course followed by comprehensive resolve [26]. On the other hand, if the cell-mediated immune reaction is feeble, the infection does not resolve, and chronic hepatitis arises with an extended course of active disease or silent asymptomatic infection [27].

About 30–80% adults of acute HBV infection shows symptoms (1% fulminant hepatitis), whereas less than 1 year old children shows no symptoms [28]. Symptoms of HBV infection include malaise, dark urine, fever, nausea, jaundice, pale stools, right upper quadrant pain, and anorexia. The risk of chronic infection of HBV is hinged on the duration of acquisition [26]. About 90% of infected neonates, 30–50% of children aged 1–4 years, and 1–10% of acutely infected adults result to persistent infection. There are approximately 15–40% with persistent infection that leads to advanced liver disease, cirrhosis, and/or HCC [8, 29].

5. How HBV infection is transmitted

Transmission of HBV in travelers is through percutaneous or mucosal exposure to HBV-infected blood or bodily fluids including saliva or semen [30, 31]. There are reports of transmission via sexual contact, contaminated blood and its products, and contaminated medical equipment and through sharing of infected needles and injecting apparatus [31, 32].

In SSA, the viral infection, is often disseminated through perinatal and horizontal route, while in the developed regions, most infections occur in adults of younger ages through injecting drug use or high-risk sexual behavior (e.g., bisexuals and homosexuals) [8, 33]. HBV infection is known to be transmitted from the mother to child and it is a thing of worry [34, 35]. Every year, about 25,000 infants are born to HBV-diagnosed mothers in the United States, and approximately 1000 mothers transmit HBV to their infants. This means that about 90% of HBV-infected newborns will eventually develop to chronic infection, and up to 25% of those infected at birth will eventually die prematurely due to HBV-related complications. Therefore, the standard care for pregnant women includes an HBV testing during each pregnancy, to prevent HBV-positive pregnant women from transmitting the viral agent to her unborn child [34, 35].

Inadequate infection control in healthcare settings also constitutes to a significant mode of HBV transmission. That is why immigrants from many countries are recommended to be tested for HBV [12]. Transmission by blood transfusion is now rare, whereas before screening of donor blood, it was not uncommon [32]. Cord blood is usually negative for the serological markers of HBV, but occasionally intrauterine infection might happen. Fetal blood sampling might enhance this risk, but amniocentesis does not appear to increase the chances of intrauterine transmission [36]. Infection presumably occurs at or soon after birth. It perhaps occurs through breast (feeding) milk, as it is known to carry the virus. Transmission could occur if there was an in apparent breach in the mucosa of the mouth or during teething [37]. Among adults, high-risk sexual activity is one of the most frequent routes of transmission for HBV [38]. Historically, male homosexual contacts have been associated with a high risk for the viral infection [38]. Sexual transmission accounts for a majority of the transmission occurring in adult life [38]. More recently, heterosexual transmission is reported to be the most common cause of acute HBV infection in adults [39]. Transmission may also continue to occur in healthcare settings. It is a result of nonadherence to isolation guidelines in a hemodialysis unit, or direct person-person exposure (e.g., surgeon-to-patient or dentist-to-patient) may transmit the virus [40]. Sharing of clothes and bed spaces could pose jeopardy because the virus could be found in saliva, tears, urine, breast milk, and any other body fluid [13]. Other possible means of transmission include an infected parent kissing the cut finger or scraped knee of his child and sharing of personal items of personal hygiene such as toothbrushes between parents and children [3].

6. Epidemiologic studies of HBV infection in travelers

There is insufficient information that depicts predisposing factors to travelers; however, there is scarcity of public reports of HBV infection in travelers, and there is low risk for travelers who are not engaged in high-risk behaviors [7]. The risk of the viral infection might increase in countries/regions that have a 2% prevalence of chronic HBV infection, such as in the African and Western Pacific regions; missionaries, long-term community development workers, and expatriates might be at high risk for the viral agent in such areas [41]. Travelers should take note on how

the virus is acquired and take precautionary measures to mitigate transmission. The risk of injury due to accident is much higher for travelers than for people in their own environment. These injuries may involve medical attention that will require injections, IVs, or blood transfusions, thereby enhancing the risk of HBV exposure [7]. Older aged travelers, especially those with heart problems, may also require medical treatments that will require the same risks of exposure.

The global prevalence of HBV indicated by the proportion of chronic HBV carriers in the population that is seropositive for the hepatitis B surface antigen (HBsAg) varies strongly between different geographical regions [12]. The virus endemicity level is different from one nation to another. The level is mostly lowered in the Western Europe, the United States, Canada, and some South American and Northern African countries (with an HBsAg chronic carrier rate < 2%); intermediate (i.e., 2–8%) in Eastern Europe, Central Asia, and some Eastern Asian countries; and high (above 8%) in Alaska, Sub-Saharan African countries, and some Asian countries [12, 42]. Infection with HBV is considered among the commonest immunization preventable infections among immigrants [12, 43]. The prevalence of the virus in travelers is associated with the status of the traveler's immunity, the duration of travel, and the level of HBV endemicity in the destination country. More so, there are peculiar populations of travelers that might be of higher risk of HBV acquisition which includes those visiting relatives and friends, the expatriates, dental surgery and medical procedure travelers, and those casual sex engagers [7]. Empirical information posited that travelers seeking urgent, unforeseen medical attention are common which makes travelers at risk of the viral agent [44]. There is paucity of empirical evidence to quantify the risk travelers might also be exposed to HBV through activities that involve tattooing, piercings, and acupuncturing [7].

Coppola et al. [42] reported HBsAg seropositivity of 9.6% among undocumented refugees and immigrants in Southern Italy. The study showed that male sex, SSA origin, low level of schooling, and minor parenteral risks for acquiring HBV infection (acupuncture, tattoo, piercing, or tribal practices) were independently associated with ongoing or past HBV infection [42]. A study in Thailand among international backpackers reported that 25% of its population had engaged in casual sex, while traveling and about half of the population did not often use condom [45]. The risk of HBV infection from sex without protection increase with the number of sex partners, and the incidence of unprotected sex was higher among the singles based on a study carried out on Dutch travelers to tropical and subtropical regions [46]. A study among Australian travelers reported that about half of them had indulged in at least one activity with an HBV risk during their last overseas trip to Southeast or East Asia [47]. Travelers without immunity for the virus traveling to high HBV prevalence countries like Nigeria might be at risk of acquiring the infection due to the many potential accidental and uncontrollable exposures during travel. A Netherlands study reported that 9% of all HBV cases between 1992 and 2003 were travel-related with an estimated incidence of HBV infection of 4.5 per 100,000 travelers [48]. In a study carried out between 1997 and 2007, HBV infection was reported in 51 cases of a cohort of ill travelers presenting to GeoSentinel clinics [49]. The study also found out that male sex and older age are associated with HBV acquisition statistically. Findings among travelers have shown that new sexual partners and unprotected sex are common, especially where there is excessive alcohol intake environment [44, 50, 51]. In countries with high HBV endemicity, the monthly estimated incidence of the infection ranges from 25 per 100,000 for symptomatic infections to 80–420 per 100,000 for all HBV infections in susceptible expatriates residing in such country [52]. Development/aid workers, volunteers, and missionaries pose greater risk of the infection due to extension of travel stay and local community close contact [7]. The prevalence of anti-HBc antibody was

5%, doubling that of the general population in a Swedish expatriate's population. Short duration of travel stay will obviously lower the risk of the infection [53]. Nielsen et al. reported that the incidence per month of HBV infection was 10.2 per 100,000 with 62% of cases traveling for less than 4 weeks [54]. Most research is hinged on travelers becoming sick after travel before testing to occur, so this tends to underestimate the incidence of the viral infection [7, 49].

Many cross-sectional research have find out that travelers have reduced baseline understanding on infections related to travels and put themselves in jeopardy to HBV infection through their actions while in foreign land [47, 55]. Nielsen et al. reported that 5% of short-term and 5% nonimmune travelers were under a great risk of getting infected with HBV via tattooing, injections, and operation activities [44]. About 41% high-risk endeavors were reported among travelers in more than 6 months with most of the endeavors being unintentional and involuntary [44]. In a retrospective study among Australian travelers, 281 (56%) had visited a country with medium to high prevalence of HBV, of whom only 43% had been vaccinated and 162 (33%) undertook activities associated with potential HBV exposure [55]. Medical tourism and transplantation of organs have been identified several times as predictors for the viral agent, which highlights that checking for transmissible infection cannot be guaranteed universally [56, 57]. A study among Australian patients finds out that 2 of 16 who traveled overseas for commercial kidney transplantation developed fulminant hepatitis related to HBV infection and died [58]. Significantly high-incidence rate of HBV infection was reported among patients receiving renal transplantations in India than in Saudi Arabia [59].

7. Genotypic distribution of HBV

Hepatitis B virus until now has been reported to have 10 genotypes (A–J) with identified peculiar distribution based on regions to its high degree of genetic heterogeneity [5, 60–62]. HBV genotyping is significant in diverse ways. First, it provides global data on the genotypic distribution of the virus including phylogenetic and phylogeographic evidence. Second, it justifies the relationship between the viral strain and course of disease. It makes us understand the role of human migration on the evolution of the virus [63, 64].

One of the three genotypes A, D, and E is predominantly circulating in Africa depending on the country. Genotype A is found in the Southern and Eastern regions, and genotype D is predominantly circulating in the Northern Africa region. Genotype E is more in most of SSA regions including Nigeria; this report excludes Uganda and Cameroon which are predominant with the A genotype [5, 60, 64, 65]. Genotype A is prevalent in Europe and Southeast Asia, including the Philippines [43, 66]. Genotypes B and C are predominant in Asia [67]; genotype D is common in the Mediterranean area, the Middle East, and India; genotype F is common in Central and South America [66]. Genotype G has been identified in Germany and France [67]. Genotype I has been detected in Laos, Vietnam, and China [68, 69], while the newest genotype J was identified in the Ryukyu Island in Japan [70, 71].

8. How HBV is diagnosed

HBsAg is the standard diagnostic marker used to screen for HBV infection in travelers. A positive test depicts an acute or chronic infection [2]. Quantifying HBsAg (qHBsAg) is also an essential tool in staging of HBV infection and predicting responses to HBV treatment. This tool depend on both viral and host factors,

such as genotype, preS/S gene variability, and hepatic disease stage [72]. The presence of hepatitis B envelope antigen (HBeAg) indicates that the virus is actively replicating and typically correlates with higher levels of HBV DNA. Immunoglobulin (Ig) G and IgM to hepatitis B core antigen indicates either that the individual has previously been infected or has an ongoing infection. IgG anti hepatitis B core (IgG anti-HBc) will often persists for life. The presence of anti-HBs shows that the individual has obtained immunity either from infection or vaccination [3, 6].

Touching upon the technical procedures behind the tests, tests for serological markers are carried out using different techniques, based on resources availability. Chemiluminescent microparticle immunoassay (CMIA) is one of those qualitative tests that detect the viral antigen in blood or serum. The technique has a high specificity and sensitivity and is based on the antigenic features (e.g., HBsAg or HBeAg) binding to commercially synthesized antibodies (anti-HB) with chemiluminescence [73]. The light produced in a chemiluminescent reaction can be measured. This method is more sensitive than the enzyme-linked immunosorbent assay (ELISA) [73].

Polymerase chain reaction (PCR) is an advanced technique to detect HBV. It amplifies the nucleic acid and greatly enhances the amount of DNA [3]. This method can qualitatively or quantitatively detect the amount of HBV DNA in patients' specimen, which reflects the replicative condition of the virus. To monitor and manage HBV infection, then a quantitative detection method is the technique of choice [73]. ALT levels are measured to help determine liver inflammation. ALT is an enzyme that is normally found in the liver, but also present in other body tissue, that is discharged into the circulation system as a consequence to hepatocellular injury [26]. ALT plays a role in characterization of HBV infection phases in synergy with HBV DNA [74]. Different noninvasive diagnoses such as aspartate aminotransferase (AST), platelet ratio index (APRI), and transient elastography (FibroScan) still exist. APRI is an index to determine the hepatic fibrosis based on a formula derived from platelet and AST concentrations [3]. FibroScan measures grade of liver fibroses through the detection of liver stiffness. Both methods are recommended by WHO to evaluate cirrhosis presence, but while FibroScan is preferred in a context where availability and cost is not an issue, APRI is used in settings with limited resources. Liver biopsy has been used to assess degree of necroinflammation and fibrosis degrees. However, the method has diverse demerits and constraints [6, 75].

9. How HBV infection is prevented and controlled

All travelers should be screened for HBV infection markers, so that they will not be at risk of acquiring the virus during stay [74]. Recently updated guidelines also recommend that pregnant women with chronic HBV be referred to a specialist and considered for HBV treatment to further reduce the chance of transmitting the virus [3]. In infants born to HBsAg-positive mothers, the risk of mother-to-child transmission is significantly greater if the mother is positive for HBeAg, has a high viral load, and/or is infected with HIV [33]. Such infants should be given both vaccine and HBIgG (0.5 ml) within 12 hours of delivery. The infants should be evaluated for HBsAg, anti-HBs, and anti-HBc at age 12 months. The presence of anti-HBs depicts vaccine-induced immunity, and detection of both anti-HBs and anti-HBc shows immunoprophylaxis-modified infection, whereas the presence of HBsAg indicates prophylaxis failure [15, 76, 77].

Individuals who have not received the HBV vaccination and are exposed to the virus (through needle stick injury, splashing, or sexual exposure to partners

infected with the viral agent) should be vaccinated with HBIG (0.04–0.07 ml/kg) as soon as possible after exposure. Immunization for the newborn babies should start immediately with the initial shot given at a site that is not similar with that for HBIG; an accelerated four dose immunization schedule (0, 1, 2, and 12 months) is required in the maternal-fetal transmission scenario [8, 77]. HBV can also be prevented by avoiding contact with contaminated blood and blood products and unprotected sexual exposure. Using condoms has also been shown to reduce the chance of sexually transmitted infections [8].

10. Immunization program for travelers

Several reasons why people did not opt for pre-travel vaccinations include traveler's pre-knowledge regarding the prevention of diseases during overseas travel, the limited number of healthcare settings that gives immunization, and that some countries have not yet approved the number of vaccines a traveler needs [9, 31].

There are commercially hepatitis B vaccines available currently, for example, recombinant HBV vaccine (Engerix-B®, GlaxoSmithKline, and Recombivax HB®, Merck & Co., Inc.) and the HAV and HBV combined vaccine (Twinrix®, GlaxoSmithKline) [78]. The complete HBV vaccination requires three shots of vaccine. The normal timeline of the three intramuscular injections is to have the second and third injections given 1 and 6 months after the first dose. An accelerated schedule (doses on days 0, 7, and 21 and then a post-travel dose at 12 months) might be required if there is an inadequate time for immunization prior to travel [79, 80]. An HBV vaccine can also be used to treat persons who have been exposed to the virus, in order to prevent disease development [31].

The prevalence of HBV differs between countries and regions, and therefore the number of persons acquiring protective immunity from a previous HBV infection also changes. Therefore, the recommendation of its vaccination should be hinged on likelihood of infection during travel and evidence of previous immunization or recovery from previous infection [74]. In those travelers without evidence of previous HBV immunity, HBV vaccination is recommended in those with HBV exposure risks and traveling to HBV endemic regions [78]. The CDC has recommend HBV vaccination to all persons without evidence of immunization before traveling to areas with intermediate and high prevalence of chronic hepatitis B and, irrespective of the traveler's destination, and based on the traveler's potential risky activities and exposures [11, 81]. High-risk activities might include unprotected sex with a new partner, getting a tattoo or piercing, or having any medical procedures like surgery [11, 81]. Studies have reported that only 19% of all American travelers and 30% of American travelers planning high-risk activities had received a completed HBV vaccination before departure irrespective of the recommendation made by the CDC [79]. This finding is in consonance with information from Europe that only 15% of international travelers to HBV endemic regions receive a completed HBV vaccination before travel [79]. There is often a very low immunity of HBV to travelers from low endemic regions and those born before the EPI schedules [82, 83]. Obviously, there are no recommendations for HBV serologic examination of international travelers currently. This might be because of the large population of international travelers, thus making it impossible to screen all for the virus. Reports have it that only 3.4–3.9% of the population in low endemic countries will have evidence of the HBV serologic markers prior infection [82, 83]. Vaccination of those populations should be considered when long-term travel is arranged to countries where HBV prevalence is intermediate or hyperendemic [31].

11. Treatment of HBV infection

There are several antiviral treatments available for chronic HBV infection, and everyone with chronic HBV should be linked to care, considered for treatment, and checked for liver damage and liver cancer regularly [84]. Therapy of HBV reduces the amount of virus in the system and lowers the chance of developing to serious liver disease and liver cancer. However, most people cannot be cured of the viral agent, and as such therapy is recommended to continue for life [85, 86].

Worthy of note is the fact that there are currently two main antiviral drugs for the treatment of chronic HBV infection [87]. They are nucleos(t)ide analogues (NA) and interferon (IFN) including normal IFNs and pegylated IFNs (Peg-IFNs). NA gives a direct antiviral effect by stopping DNA polymerase. It is usually given orally. There are six types of NAs as approved for treatment of HBV by the WHO: Lamivudine (LAM), Adefovir (ADV), Telbivudine (TBV), Entecavir (ETV), Tenofovir disoproxil fumarate (TDF), and Tenofovir alafenamide (TAF). IFNs, especially the Peg-IFNs, have a suppressed antiviral effect than the NA therapy, but its persistent effect can be achieved with a finite therapy. It is usually given via subcutaneous injection. There are reports of combination therapy of NA + NA and Peg-IFN + NA [86, 87].

There are serious ongoing clinical trials for the development of more effective treatments and a cure for HBV infection [3, 6].

12. Way forward in curbing HBV as a traveler's infection

12.1 Early screening and treatment

Early screening and treatment will help mitigate frequent transmission of the viral agent and curb morbidities and mortalities in infected persons [85]. The first line should be to give the exact medical advice and start antiviral treatment, if available. Sadly, undergoing this step is often a problem in developing regions where there is lack of access to good healthcare facilities, and antiviral treatment is often exorbitant [6, 86].

12.2 Advocacy of immunization exercise

Advocacy of immunization exercise for HBV infection should be key in eliminating the viral agent worldwide which is central to WHO's agenda [6, 10]. To maximize implementation of the WHO agenda, provision of technical guidance and support to reduce transmission of the disease such as adhering to safer blood transfusion and disposable needles among others. The virus vaccine is very effective in preventing disease progression. It has been reported that only 27% of newborn babies had receive a birth dose of hepatitis B vaccine globally [86]. Birth dose vaccination of the viral agent is fundamental to halting mother-to-child transmission as late immunization is not fully effective in destroying the chain of mother-to-child transmission. Coordination between maternal health services and immunization should be effectively established [88].

12.3 Self-protection measures

Self-protection measures are one of the pre-travel counseling given to potential travelers to HBV and other blood-borne pathogen endemic regions [7, 8, 43]. Persons should be guided from contaminated items or equipment used in medical

or cosmetic procedures, blood products, injection drug use or any exercise that involve piercing the skin or mucosa, or unprotected sexual activity. Travelers should be advised properly against the use of equipment that is not properly sterilized or disinfected on medical or beautification tourism (such as tattooing or piercing) [8]. The viral agent can be disseminated to others if tools are not sterile or if personnel do not follow proper infection control protocols [89].

12.4 Educational awareness

Educational awareness and programs that will be targeted towards HBV awareness lowers transmission of the infection [90, 91]. There is a large pool of persons suffering from chronic HBV infection in Sub-Saharan Africa that are not aware of their situation. Educational awareness and implementation of local health measures are pertinent in eradicating the scourge of the infection [2]. These should include training local communities on how to perform safe blood transfusion and establishing efficient screening methods for transfusion of donated bloods. Health education programs should include administration of safe injections (intravenous drug users and healthcare settings) and implementation of safer sex practices (especially the use of condoms). More so, occupational safety trainings should be advocated for health workers [92]. It is also worthy to note that effective communication and emphasizing the role of the virus testing, follow-up visits, and monitoring therapy will help eliminate HBV infection [43].

12.5 Socioeconomic condition enhancement

Enhancing the socioeconomic conditions of a particular population has shown reduction in the rate of HBV infection. Government and non-governmental organization (NGO) bodies should ensure that there is a universal access to portable water and encourage food handling that is safe and hygienic [92]. They should also implement good sanitation systems. Safe disposal practice of medical waste should be advocated in the health settings [43].

13. Conclusion

There are ongoing development of two novel anti-HBV drugs, namely, Besifovir and Myrcludex-B that will soon be in the market [3]. The infection is one of those preventable infections by immunization in travelers. Therefore, travelers should often be screened and immunized for HBV infection before traveling to endemic countries because immigrants and/or travelers who have the viral infection pose a great risk of HCC and death. They as well serve as transmitters of the viral agent to those not infected when returned from travel. Continuous health surveillance and strict checking of migrants to ascertain previous vaccination evidence will go a long way in mitigating the infection across travelers. There is no single measure strong enough to curb viral hepatitis epidemics, but having a global vision and implementing multiple strategies will go a long way towards eliminating HBV infection and other global disease burden in 2030.

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