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A Review on Prevention of Hepatitis B with the Hepatitis B Vaccine

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ABSTRACT: ***Around 350 million people worldwide are infected with HBV, which is a leading cause of end-stage liver failure, hepatocellular cancer, and mortality. New therapeutic treatments have increased the number of HBV treatment options available, but since current medications are usually used for the remainder of one's life, getting the best start is crucial. After obtaining a positive pregnancy test results, a 25-year-old registered nurse pays a visit to begin prenatal care. She says that when she was given hepatitis B vaccine by her present job, she rejected it since she does not take blood and therefore does not consider herself at danger of infection. The age at the time of infection has an inverse relationship with the likelihood of developing a chronic carrier status. Infected newborns have a 90 percent chance of developing chronic carriage. In medical settings, improved disposal of needles and other sharp items, as well as innovative technologies intended to minimize the danger of accidental needle jabs, have reduced exposures.***

KEYWORDS: ***Human, Infections, HIV, Hepatitis B, Vaccinations.***

1. INTRODUCTION

Hepatitis B virus is a double-stranded DNA virus that is encapsulated. It's the tiniest DNA virus ever discovered to infect humans. In nonimmune people, the virus is very contagious. The incubation time for acute infection ranges from 45 to 160 days, with a 90-day average. Chronically infected individuals are the main reservoir. There are no known animal reservoirs for HBV, and there is no conclusive evidence that HBV is transmitted by insects. Acute HBV infection may cause symptoms or go unnoticed. Following the acute phase, the infection either clears up or becomes a chronic, indolent illness that may progress to cirrhosis, liver failure, hepatocellular cancer, and death. In Taiwan, prospective studies of infection show that 25% of those who have a chronic HBV infection throughout childhood or adolescence die from hepatocellular carcinoma or cirrhosis. For chronic infection that develops in teens and young adults, the mortality rate drops to 15%.

1.1.Epidemiology:

HBV infection is found all throughout the globe, but is most prevalent in Africa, Eastern Europe, the Middle East, Central Asia, China, Southeast Asia, the Pacific Islands, and South America's Amazon basin. The majority of people in these regions get infected as babies or early children, and up to 70% of the adult population tests positive for previous infection. Chronic HBV infection affects 8 to 15% of those populations. This equates to over 2 billion individuals with evidence of past HBV infection and over 350 million chronic HBV carriers worldwide, with an estimated 1 million deaths owing to cirrhosis and hepatocellular cancer each year. HBV vaccination programs, which have been adopted in more than 100 countries, have significantly decreased the incidence

of chronic HBV infection and hepatocellular carcinoma, making the vaccine the first anticancer vaccine. In the United States, serologic tests to identify HBV, hepatitis C virus, human immunodeficiency virus, and human T-cell lymphotropic virus in blood and blood products have significantly decreased the spread of these viruses via transfusions. In addition, effective immunization campaigns have led in high vaccination and prenatal screening rates[1].

1.2.Infection and Transmission Sources:

Percutaneous or mucosal contact to the blood or body fluids of infected people causes HBV infection. It is not necessary for infected people to show symptoms in order to spread the virus. Viruses are found at the highest quantities in blood. Sexual contact, contaminated needles, contaminated blood or blood product, or prenatal exposure to an infected mother are all common causes of infection. The source of exposure is unclear in up to one-third of instances with acute HBV infection. Long-term exposure in a home environment has been linked to nonsexual transmission. Horizontal transmission of HBV seems to be possible among babies, children, or elementary school student who reside with an infected household member, but the mechanism remains unknown. The fecal–oral pathway does not transfer HBV. Young people (18 to 39 years old) have a higher risk of HBV infection than other age groups. This is due to a higher probability of numerous sex partners (defined as four or more sex partners throughout one's lifetime), illegal substance injection, and other high-risk activities in this age range[2].

1.3.Vaccination against hepatitis B:

In the United States, hepatitis B vaccinations have been available since 1981. Several formulations (Merck's Recombivax HB or Comvax; are currently available in the United States. They all utilize yeast (Saccharomyces cerevisiae) and recombinant methods to create the hepatitis B surface antigen (HBsAg) protein. The Advisory Committee on Immunization Practices (ACIP) proposed a comprehensive plan for eradicating HBV transmission in the United States in 1991, which includes universal newborn immunization. Adolescent vaccinations became standard in 1995. The plan was revised in 1999 to include vaccination of all people under the age of 18 years. The total yearly incidence of acute HBV infections in the United States has decreased as a result of this approach

1.4.Vaccine administration:

All presently approved hepatitis B vaccinations are administered intramuscularly, 14-18 either in the thigh (for newborns and infants) or in the deltoid muscle (for adults) (for children, adolescents, and adults). The needle should be long enough to go deep into the muscle. A typical 12.7-cm (5/8-in.) needle is inadequate for many individuals to pierce the deltoid fat pad and result in intramuscular vaccination deposition. 18 With increasing body weight, the necessary needle length rises (Table 1). 18 In individuals who have not had a reaction, some researchers advise using divided, smaller dosages given as repeated intradermal vaccination (i.e., the anti-HBs antibody level is less than 10 mIU per milliliter after the third dose of vaccine). 19,20 This approach is not advised since it may result in decreased immunogenicity[3].

1.5.Immunogenicity of vaccines:

With advancing age, the antibody response decreases. Patients over the age of 30 have a higher chance of non-response to the HBV vaccination than younger people. 22 As a result, vaccination in childhood or adolescence gives the best protection22 and confers lifetime immunity. After the vaccination series is finished, 95% of healthy people and 95% of babies, children, and adolescents have protective serum anti-HBs antibody concentrations. 23 The vaccination is almost 100 percent effective in immunocompetent people who acquire antibody levels of at least 10 mIU per milliliter[4].

1.6.Absence Of Response:

In persons with risk factors for a lack of response (such as age greater than 30 years, obesity, as well as immunodeficiency) or those at high risk for exposure to blood or bodily fluids, the antibody response (anti-HBs antibody level) should be determined within one to three months after the last dose of vaccine. Unfortunately, the antibody response is often measured years after the vaccination series has been completed, making it difficult to differentiate between genuine nonresponse (an antibody level of less than 10 mIU per milliliter following the proper vaccine series) and "waning" antibody levels (those that are initially protective but that become undetectable over time).

1.7.Safety:

The current approved vaccinations, as well as the prior plasma-derived vaccine, have been shown to be safe. Concerns about illness risks (such as autoimmune diseases caused by vaccines, diabetes, chronic fatigue syndrome, demyelinating disorders, optic neuritis, and other syndromes) are not backed up by scientific evidence. Multiple studies have shown no link between hepatitis B vaccination and the onset, recurrence, or aggravation of demyelinating diseases. Concerns about thimerosal and aluminum in vaccinations have also been debunked by well-conducted research. The Institute of Medicine, the World Health Organization's Global Advisory Committee on Vaccine Safety, and a number of other independent scientific organizations have determined that the hepatitis B vaccine is both safe and efficacious[5].

1.8.Immune Globulin for Hepatitis B:

Hepatitis B immune globulin is used to prevent hepatitis B infection in people who have never had a hepatitis B infection and have been exposed to the virus perinatally (i.e., newborns born to HBsAg-positive mothers), by cutaneous as well as mucosal contact with HBsAg-positive blood or other body fluids, or by sexual contact with a person who is positive for HBsAg, or in infants younger

13 One dose of hepatitis B immune globulin is usually given together with the first dose of the hepatitis B vaccination series as soon as feasible after exposure (within 24 hours after delivery for perinatal exposure, within 7 days after needle-stick exposure, and within 14 days after sexual exposure) (followed by additional doses of vaccine on the usual schedule). This method is said to be 85 to 95 percent effective in preventing neonatal infection and around 75 percent effective in preventing infection following a needle puncture or sexual contact.

1.9.Hepatitis B screening in mothers:

To avoid vertical transmission, females should be tested for HBsAg at their first prenatal appointment and checked again in late pregnancy if seronegative but at high risk. Nonimmune, uninfected pregnant women with risk factors may be vaccinated since the hepatitis B vaccine is safe to use at any stage of pregnancy. The management methods for babies born to HBs-positive moms are outlined. At 9 to 15 months of age, all such babies should be tested for antiHBs antibodies and HBsAg. Although some writers have suggested a 5- or 10-year booster dosage, there is no evidence to back up these claims, and neither the ACIP nor any recognized U.S. or European professional organization presently advises booster doses on a regular basis. Nonetheless, since the vaccine has not been regularly administered for so long, it is unclear if protective antibody levels are still present three or more decades after vaccination. The significance of possible variations in immunogenicity across presently available vaccine formulations38, as well as the effects of various dosage regimens and intervals, remain unanswered[6].

The function of novel HBV vaccinations in development is yet unknown. In those who do not respond to a normal series of three doses of 10 or 20 g, so-called mixed-particle vaccinations (which include pre-S1, pre-S2, and S antigens) have not been shown to be superior to S subunit vaccines given in larger doses (40 g). Two doses of a new recombinant vaccine comprising pre-S2 or S subunits with an MF59 adjuvant resulted in an 89 percent seroprotection rate and substantially greater antibody titers than three doses of a licensed vaccine. DNA vaccines for HBV have also been tried and shown to elicit antibody responses in those who did not have long-lasting responses following a conventional vaccination series in one research. The Food and Drug Administration has not yet authorized these new vaccination candidates[7].

2. LITERATURE REVIEW

S.Y.Kwon et al. studied about the Hepatitis B virus (HBV) infection is a leading cause of morbidity and mortality worldwide. The issue was recognized, and a global effort was launched to decrease HBV transmission via regular newborn immunization. In Korea, HBV infection is the leading cause of chronic liver disease as well as hepatocellular carcinoma. Seroprevalence of hepatitis B surface antigen is decreasing, particularly in children, following the introduction of the hepatitis B vaccine. The hepatitis B vaccination is very safe and has a high immunogenicity rating. In the first year of life, universal childhood vaccination with three doses of hepatitis B vaccine is a very efficient approach for preventing and controlling hepatitis B[8].

C. E.Stevens et al. studied about Hepatitis B virus (HBV) prevention and eradication require preventing HBV transmission from infected mothers to their infants. Perinatal transmission from mother to child has the greatest chronic carrier rate (>85%), as well as a high risk of chronic liver disease or hepatocellular cancer. HBV vaccination combined with hepatitis B immune globulin (HBIG) administered beginning at birth reduces this risk by 90%. New analyses of our data from high-risk infants in US trials of HBIG and HBV vaccine revealed that yeast-recombinant vaccine was more effective than plasma-derived vaccine in trying to prevent late-onset infections, with evidence that vaccine prevented transfer of information of maternal HBV infection with the glycine to arginine mutated gene in surface antigen codon 145. (sG145R). The majority of late infections with sG145R occurred in vaccination non-responders, indicating that the virus escaped

HBIG rather than vaccine-induced antibodies. Our findings also assist to explain survey data from Taiwan after the mid-1980s implementation of universal childhood vaccination. Current vaccinations will continue to be effective against surface antigen mutations, according to our findings. In high-risk pregnant women, anti - viral drugs in combined effect with newborn HBIG and vaccine show promise in eradicating residual breakthrough neonatal infections, which is critical for meeting WHO 2030 goals as well as eradicating HBV[9].

K. Watterberg et al. studied about the hepatitis B vaccination was introduced in the United States in 1982, and it resulted in a 90 percent decrease in new infections. In the United States, however, around 1000 new instances of perinatal hepatitis B infection are discovered each year. Perinatal hepatitis B prevention depends on the accurate or timely identification of babies born to hepatitis B surface antigen positive mothers and women with uncertain status so that adequate postexposure immuno prophylaxis with hepatitis B vaccination and immune globulin may be administered. The American Academy of Pediatrics supports the recommendation of the Advisory Committee on Immunization Practices of the Centers for Disease and Prevention that all infant infants with a low birthweight of greater than or equal to 2000 g receive hepatitis B vaccine by 24 hours of age to further reduce the frequency of perinatal hepatitis B transmission[10].

Aaron et al. studied about The WHO Hepatitis B Elimination Strategy 2016-2021 includes hepatitis B immunization for healthcare workers (HCWs). There are little statistics on current hepatitis B vaccination coverage among health-care professionals in Sub-Saharan Africa, however these data are critical for successful programming. At a Tanzanian national hospital, we looked at the percentage of HCWs who were vaccinated for hepatitis B and the variables that contributed to sufficient vaccination coverage. Methods: Between July 30th and September 30th, 2015, a descriptive cross-sectional research was performed among consenting healthcare professionals. Self-administered questionnaires were used to collect vaccination histories. The data was summarized using means and proportions. As needed, student's t and chi-squared tests were performed. Despite a high degree of knowledge and acceptance of the vaccine, immunization coverage among practicing healthcare professionals at Muhimbili National Hospital is low. Improved availability to the vaccination, particularly for newly hired HCWs, should be part of any expedited and coordinated efforts to increase vaccine uptake. It would be beneficial to expand the research to include private healthcare settings and lower-level institutions[11].

3. DISCUSSION

Hepatitis B virus (HBV) is a double-stranded DNA virus that is encapsulated. It's the tiniest DNA virus ever discovered to infect humans. In nonimmune people, the virus is very contagious. The incubation time for acute infection ranges from 45 to 160 days, with a 90-day average. Chronically infected individuals are the main reservoir. There are no known animal reservoirs for HBV, and there is no conclusive evidence that HBV is transmitted by insects. Acute HBV infection may cause symptoms or go unnoticed. In nations where the HBV vaccination is extensively administered, it has been linked to a significant reduction in the incidence of HBV infections and hepatocellular cancer. Because HBV infection is so severe, physicians should work hard to achieve universal vaccination of babies and children up to the age of 18, as well as to identify and vaccinate those who are at risk for infection. If the test is positive, the baby will need hepatitis B immune

globulin and immunization at birth, and further research will be required to establish if the infant's father (or, possibly, other sexual partners of the mother) is the source of infection. This patient should be examined again in her final trimester of pregnancy if she is not at high risk. Even if she does not take blood, we would suggest vaccination due to the possibility of work-related exposure, since the HBV vaccine is not contraindicated during pregnancy.

4. CONCLUSION

In nations where the HBV vaccination is extensively administered, it has been linked to a significant reduction in the incidence of HBV infections and hepatocellular cancer. Because HBV infection is so severe, physicians should work hard to achieve universal vaccination of babies and children up to the age of 18, as well as to identify and vaccinate those who are at risk for infection. Testing for HBsAg is recommended for pregnant women, such as the lady depicted in the vignette, to minimize the risk of vertical transmission. If the test is positive, the baby will need hepatitis B immune globulin and immunization at birth, and further research will be required to establish if the infant's father (or, possibly, other sexual partners of the mother) is the source of infection. This patient should be examined again in her final trimester of pregnancy if she is not at high risk. Even if she does not take blood, we would suggest vaccination due to the possibility of work-related exposure, since the HBV vaccine is not contraindicated throughout pregnancy.

REFERENCES

[1] J. Dionne-Odom *et al.*, "Predictors of Infant Hepatitis B Immunization in Cameroon: Data to Inform Implementation of a Hepatitis B Birth Dose," *Pediatr. Infect. Dis. J.*, 2018, doi: 10.1097/INF.0000000000001728.

[2] G. A. Poland and R. M. Jacobson, "Prevention of Hepatitis B with the Hepatitis B Vaccine," *N. Engl. J. Med.*, 2004, doi: 10.1056/nejmcp041507.

[3] S. Anderson, L. Harper, J. Dionne-Odom, G. H. Ekane, and A. Tita, "390: Prevention of hepatitis B in sub-Saharan Africa: a decision analytic model for the birth dose vaccine," *Am. J. Obstet. Gynecol.*, 2017, doi: 10.1016/j.ajog.2016.11.1055.

[4] S. Locarnini, A. Hatzakis, D. S. Chen, and A. Lok, "Strategies to control hepatitis B: Public policy, epidemiology, vaccine and drugs," *Journal of Hepatology*. 2015, doi: 10.1016/j.jhep.2015.01.018.

[5] D. Shouval, H. Roggendorf, and M. Roggendorf, "Enhanced immune response to hepatitis B vaccination through immunization with a Pre-S1/Pre-S2/S Vaccine," *Medical Microbiology and Immunology*. 2015, doi: 10.1007/s00430-014-0374-x.

[6] S. Schillie *et al.*, "Prevention of hepatitis B virus infection in the United States: Recommendations of the advisory committee on immunization practices," *MMWR Recomm. Reports*, 2018, doi: 10.15585/mmwr.rr6701a1.

[7] C. W. Spearman *et al.*, "Hepatitis B in sub-Saharan Africa: strategies to achieve the 2030 elimination targets," *The Lancet Gastroenterology and Hepatology*. 2017, doi: 10.1016/S2468-1253(17)30295-9.

[8] S. Y. Kwon and C. H. Lee, "Epidemiology and prevention of hepatitis B virus infection.," *The Korean journal of hepatology*. 2011, doi: 10.3350/kjhep.2011.17.2.87.

[9] C. E. Stevens *et al.*, "Eradicating hepatitis B virus: The critical role of preventing perinatal transmission," *Biologicals*. 2017, doi: 10.1016/j.biologicals.2017.08.008.

[10] K. Watterberg *et al.*, "Elimination of perinatal hepatitis B: Providing the first vaccine dose within 24 hours of

birth," *Pediatrics*, 2017, doi: 10.1542/peds.2017-1870.

[11] D. Aaron, T. J. Nagu, J. Rwegasha, and E. Komba, "Hepatitis B vaccination coverage among healthcare workers at national hospital in Tanzania: How much, who and why?," *BMC Infect. Dis.*, 2017, doi: 10.1186/s12879-017-2893-8.