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Seroprevalence of Hepatitis B and C Virus in Blood Donors at Lewanika General Hospital, Mongu, Western Province, Zambia

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Abstract

Infection with hepatitis B and C virus affects the liver and results in a broad spectrum of disease outcomes. This study was carried out to determine the prevalence of antibodies to Hepatitis C Virus (HCV) and Hepatitis B surface Antigen (HBsAg) among blood donors of Lewanika General Hospital in Mongu, Western Province, Zambia in order to generate data which may be useful to the appropriate health authorities. The participants included in this study were 22,007 (11,994 males and 10,013 females; aged 16 to 55 years) voluntary, first time and replacement donors.

The samples were tested for the presence of Anti HCV and HBsAg using the Architect plus i2000 automated machine which uses chemiluminescent technique. Analysis of the result showed that 1,463 (6.65%) of the donors had HBsAg. The result showed highest HBsAg prevalence of 6.74% amongst blood donors in the age range 16-35 years and males having the highest prevalence of 6.65%. Our results further showed that 544 (2.47%) of the donors had antibodies to HCV, with high prevalence in the age range of 16-35 (6.82%). HCV prevalence was higher in male than female blood donors, with male blood donors having the prevalence of 2.72% and females 2.18%.

Our study and review of literature shows that the seroprevalence of Hepatitis B and C among blood donors in Zambia is high with the younger blood donors mostly affected. The high prevalence of both HCV and HBV obtained in this study is lower as compared to results obtained in studies done in other sub-Saharan countries but much higher than in Asia and Europe.

There is urgent need for renewed intensification of prevention programmes aimed at changing high-risk behaviors among Zambian youths and vigilant donor selection with introduction of more sensitive tests (such as nucleic acid amplification testing [NAT] for HBV and HCV) that detect infection earlier, will further decrease risks of transfusion-transmitted viral infections.

Keywords: Prevalence, transfusion transmissible infections, blood donors, HCV, HBV

Introduction

Hepatitis B and C infections are major public health problems in developing countries^[1]. HBV and HCV are the most causes of chronic liver disease globally. Hepatitis B and C are transmitted parentally mainly as a result of blood to blood contact including injury with contaminated instruments and sharing of needles or by sexual contact and also through perinatal transmission from mother to child^[2, 3]. HBV and HCV are the two established causes of post transfusion hepatitis. Prevalence of transfusion-transmitted diseases is much lower in healthy voluntary blood donors as compared to professional blood donors^[4]. Both infections can lead to an acute or silent course of liver disease progressing from liver impairment to liver failure, cirrhosis of the liver and to hepato-cellular carcinoma.

Hepatitis B virus (HBV) infection is one of the most common infectious diseases in the world with significant acute and chronic morbidity and thus has become a global public health problem. The presence of HBsAg in serum indicates active HBV infection, either acute or chronic. Usually, HBsAg is the first serologic marker in acute HBV infection and is detected 2-4 weeks before the alanine aminotransferase (ALT) level becomes abnormal and 3-5 weeks before symptoms or jaundice^[5]. The World Health Organization (WHO) has estimated that more than 2 billion people in the world have been infected with HBV at some time in their lives and about 350 million people worldwide are HBV carriers with the majority in developing world mainly in Asia and Africa^[6]. The worldwide carrier rate of HBV is more than 350 million (Dienstag 2001)^[7] these carriers provide a huge reservoir for HBV. It is estimated that about one million people die each year from HBV related chronic liver disease^[8].

Studies done in Zambia showed the prevalence of Hepatitis B antigen depended on location, time, and HIV status of the patient. In the era before HIV, the prevalence of HBV among healthy blood donors was found to be 5.0%, though more recent unpublished records at the ZNBTS show a prevalence of 8.0% in healthy blood donors [9]. The prevalence was higher in HIV positive patients than in HIV negative patients, with rates of 31.3% and 16.8%, respectively (p=0.0003) [10]. However, earlier studies have shown a lower prevalence of HBV in both HIV positive and negative patients with a prevalence of 7.1% and 5.4% among pregnant women attending prenatal clinic respectively [11].

Hepatitis C virus (HCV) continues to be a major disease burden in the world. In 1997, WHO estimated a worldwide prevalence of about 3% with the virus affecting 170 million people worldwide and 3 to 4 million new infections each year [12]. Among the viral hepatitis, HCV is dreadful in the aspect that its morbidity rate is high as it establishes a state of chronic infection in as many as 85% of acutely infected patients, whereas about 15% of acutely infected patients spontaneously clear the infection [13, 14].

The prevalence of HCV was shown to be 0.41% in a 1996 study done in Zambia, while a more recent unpublished study done at the ZNBTS showed a prevalence of 0.5% [11, 15].

Considering the grave consequences of these infections and to reduce the transmission, it is extremely important to monitor these viral transfusion transmissible infections. Thus we aimed to estimate the prevalence of HBV and HCV among the blood collected from the donors at a hospital based blood bank in Western province, Mongu, Zambia. This research would help to study and identify the trend of increase or decrease of HBV and HCV.

Materials and Methods

This was a retrospective and cross-sectional study conducted at Lewanika General Hospital, in the Western Province of Zambia from January 2012 to April 2015. For the period from January 2012 to December 2014, data were retrospectively collected for Hepatitis B and C results for blood donors and a total of 19,133 donations were carried out during this period. Hepatitis B and C results for the period from January to April 2015 was obtained by testing blood donor samples for HBV and HCV. During this period 2,874 donations were done. Three milliliters of venous blood samples were taken from each blood donor into a clean dry tube. Blood samples were allowed to stand at room temperature for clotting and retraction. Thereafter, the samples were centrifuged to give a clear serum. The samples were screened for HBV and HCV using the Architect plus i2000 machine manufactured by Abbott laboratories based in Germany. This equipment uses the chemiluminescent microparticle immunoassay technique. Data was analyzed using a Statistical Package for Social Sciences (SPSS version 16). Ethical clearance for this study was obtained from the Ndola College of Biomedical Sciences Ethics committee and permission to conduct this study was obtained from the Provincial Medical Officer (PMO) Western, Province, Zambia.

Results

A total of 22,007 donors were screened and among these 54.5% (11,994) were males and 45.5% (10,013) were females. Among them, 1,463 donors were found seropositive for HBV giving the seroprevalence of 6.65%. The HBV seroprevalence in male donors was 6.74% and in female donors was 6.53%. 544 donors were found seropositive for HCV giving a

seroprevalence of 2.47%. HCV seroprevalence in male and female donors was 2.72% and 2.18% respectively. The overall prevalence of HBV and HCV was 6.65% and 2.47% respectively. The difference in seroprevalence for HBV and HCV was statistically significant (P< 0.0001) using the Chi-square test. Seroprevalence of HCV and HBV was higher in younger donors as compared to older donors. Table 1, 2 and Fig 1.

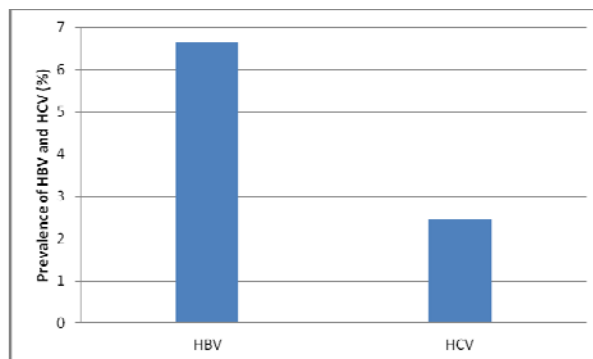


Fig 1: Prevalence of HCV and HBV prevalence in Western Province, Zambia (Jan 2012-April 2015)

Table 1: HBV and HCV Prevalence by Sex in western province, Zambia (Jan 2012- April 2015)

Sex	N (%)	HBV Positive N (%)	HCV Positive N (%)
Male	11,994 (54.5)	809(6.74)	326 (2.72)
Female	10,013 (45.5)	654(6.53)	218(2.18)
Total	22,007 (100)	1,463(6.65)	544 (2.47)

Table 2: Prevalence of HCV and HBV by age from Jan 2012-April 2015, Western Province-Zambia.

AGE	N (%)	HCV Positives N (%)	HBV Positives N (%)
16-35	13,454 (61.1)	341 (2.53)	918 (6.82)
36-65	8,553 (38.9)	203 (2.37)	545 (6.37)
	22,007 (100)	544 (2.47)	1,463 (6.65)

Discussion

The overall prevalence of HBV in this study was 6.65%. This result was lower than that obtained by Kew *et al.* and Kasolo *et al.* [9, 10]. In other Sub-Saharan African countries, 15% has been reported from Ghana [16], 8.2% from Ethiopia [17], 14.0% from Central African Republic [18], and 8.8% from Tanzania [19], suggesting that values obtained from this study are much lower than that obtained in other sub Saharan African Countries. However the results are much higher than those obtained in other parts of the world such as Australia with 0.01% [20], India with 0.66% [21], Iran with 0.56% [22], Saudi with 1.5% [23], and Turkey with 4.2% [24]. The presence of occult hepatitis B virus in blood donors is considered a potential risk for transfusion of hepatitis B virus and that is why screening for occult hepatitis B infection through the use of nucleic acid testing (NAT) of blood donors has been adopted in advanced countries. Low levels of HBV-DNA remain detectable, through NAT, in serum and liver tissue in some patients who cleared HBsAg from acute self-limited infection [25] and can result in overt hepatitis B infection, particularly when such blood is transfused to immunocompromised patients [26]. The use of NAT could have probably been responsible for the reduction of the prevalence of hepatitis B infection in the developed world as shown by the significantly low values reported. The main advantage of

NAT screening is that it facilitates the detection of cases during the window period [27] and hence the transmission of viral infected blood through blood transfusion has virtually been controlled in most advanced countries.

There is a need for universal vaccination against HBV to be introduced in Zambia. Evidenced- based best practices in Korea and other developed countries indicate that universal vaccination can produce a significant reduction in the residual risk of HBV infection [28]. The residual risk of HBV in countries with low prevalence (<2%), such as the UK, was 1 in 296,736 in the 1990s, and 1 in 729,927 donations in the 2000s [42]. The residual risk of HBV in countries with moderate to high prevalence declined from 1 in 10,700 to 1 in 340,000 during a similar period [29, 30].

The sero-prevalence of 2.47% obtained for anti-HCV is higher than what was obtained ten years ago at ZNBTS in Lusaka, Zambia [15]. In other sub-Saharan Africa countries, Matee *et al.* [19] reported 8.0% in their study in Tanzania, 8.4% was reported by Ampofo *et al.* from Ghana [16], 5.8% from Ethiopia [17], 5.0% from Central African Republic [31], and 7.6% from Egypt [32].

In the absence of NAT screening method for HCV, efforts should be maintained at keeping false negative anti-HCV in our donated units low through stringent donor criteria and excluding subjects with high risk behaviors as studies have shown that the most efficient mode of transmission of HCV is blood to blood contact [33, 34], less efficiently through sexual route unlike HBV and HIV infection [35, 36]. Similar high values have been reported in some African countries, including Tanzania (4.7%) and Ghana (7.5%) [19, 37]. Sexual activity and blood and blood products transfusion are major sources of transmission. Studies have shown that multiple co-infections, particularly hepatitis B and hepatitis C virus dual infection are associated with substantial risk of fulminant hepatitis [38] and a more severe histological lesions [39] and poor response to therapy [40]. HCV infection has also been shown to suppress HBV replication and with low HBV-DNA levels, decreased HBV-DNA polymerase activity, and decreased expression of HBsAg expression in blood [41] which may lead to false HBsAg negativity thereby presenting as occult hepatitis. In view of this, HBV coinfection with HCV should not be excluded by mere negative HBsAg status alone [42]. Prevalence of HCV may be on an increase probably because of the high prevalence of HIV infection. HIV infection increases HCV replication and accelerates progression of HCV disease due to accompany immunosuppression associated with HIV infection [43, 44]. In view of all the negative interactions between transfusion and transmissible infectious agents, it is important to continue to apply stringent measures in donor recruitment, particularly on their social behaviour, and for clinician to transfuse when it is absolutely necessary.

Factors contributing to a high transfusion-related transmission in sub-Saharan Africa include; high rate of transfusion in some groups of patients (particularly, children and women), high prevalence of TTI's in the general population and the blood donor population, inadequate screening facilities and lack of infrastructure and capacity to ensure sustainable operation [45].

In this present study, we observed a higher male gender predisposition to HBV infection. Our finding is consistent with a previous report among Namibian blood donors in which the prevalence of hepatitis B was significantly higher among male compared to female blood donors [46]. The reason for this male gender predisposition may be due to the fact that maintenance of multiple sex partners among men is prevalent in the area.

However, comparisons of the prevalence of blood-borne viruses among different sex blood donors may not be valid because of high percentage of male blood donors; this is due to low hemoglobin in female and the fact that women are less willing to donate blood. The high ratio of male to female blood donors in this study was similar to other countries [47]. In this study, we observed a higher prevalence of HBsAg among blood donors in the 16-35 years age group. This is in contrast with the work of Mustapha and Jibrin [48], which reported that the highest rate of HBsAg sero positivity of 41.6% among donors in the 40-49 years age group. Our finding is in agreement with previous results reported by Baba and colleagues [49] and Ejele and coworkers [50] in which higher HBV prevalence were observed among youths. This observation paints a bad picture for the Zambian Nation since the most productive and economically viable age group of the population is worst hit. There is urgent need for renewed intensification of prevention programmes aimed at changing high-risk behaviors among Zambian youths. The high prevalence of HBV among the youth could be as a result of the high risk behavior such as maintenance of multiple sex partners, tattooing, having unprotected sex, intravenous drug abuse and other unhygienic activities involving youths. The economic costs of the failure to control the transmission of infection among young Zambian include increased requirement for medical care, higher level of dependency and the loss of productive labor force, thereby placing heavy burdens on the already overstretched health and social services and on the natural economy [51]. The prevalence rates of hepatitis C were higher among younger age group than among older group age group. These results are in contrast with what was obtained by Fathi Abed Al-Gani [52] in Jordan, but in agreement with CDC, which has estimated that 3.9 million people worldwide are infected with HCV, with the highest prevalence among the age group 30–39 year and about 8000–10000 deaths/year arising from HCV infection [53]. Hepatitis affecting younger age group leads to liver damage at an earlier age putting extra burden on health services for a longer period of time. This warrants raising people's awareness through the media and universal screening of blood for HBV and HCV. The situation at present is grim though screening of blood donors for HBV and HCV is being carried out routinely in western province early detection of the viral hepatitis is very difficult. Detailed epidemiological studies would be needed to further document the prevalence of seroreactivity of Hepatitis B and C in the general population and also to test the hypothesis that have been suggested in the present study. These will help in designing studies for elucidating the natural history, including modes of transmission of HCV other than parenteral transmission in our population. Larger population vaccinated for Hepatitis B may further lower the prevalence of Hepatitis B. It is important to undertake measures to keep the prevalence of viral hepatitis at low levels.

Study limitations and recommendations

Our study has some important limitations. First, the selected blood donors were chosen according to certain exclusion criteria which probably reduced the prevalence of both HBsAg and anti- HCV antibodies. Secondly, we did not perform additional laboratory tests of interest, including anti-hepatitis B core antigen (anti-HBc), confirmatory testing for anti-HCV antibodies and HBsAg positive samples, and HCV-RNA was also not determined in any of the anti-HCV antibody-positive patients in order to differentiate between active and resolved infection. The presence of anti-HBc antibody is a lifelong

marker of HBV infection, irrespective of whether a patient has recovered from or has an ongoing chronic infection. Further studies are recommended among other blood donors and among different population groups in order to know the real prevalence and to study the epidemiology of both diseases. It is also recommended to perform confirmatory tests for both anti-HCV and HBsAg to confirm the rate of positive cases and cut-off values. Finally, implementation of more sensitive tests (such as nucleic acid amplification testing [NAT] for HIV, HBV and HCV) that detect infection earlier (reduce the window period) will further decrease risks of transfusion-transmitted viral infections.

Conclusion

The study shows that the seroprevalence of Hepatitis B and C among blood donors is high in Zambia and the younger blood donors are mostly affected. There is urgent need for renewed intensification of prevention programmes aimed at changing high-risk behaviors among Zambian youths and vigilant donor selection with introduction of more sensitive tests (such as nucleic acid amplification testing [NAT] for HBV and HCV) that detect infection earlier (reduce the window period) will further decrease risks of transfusion-transmitted viral infections.

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