HEPATITIS B AND C VIRAL INFECTIONS AMONG BLOOD DONORS FROM RURAL GHANA

B. NKRUMAH[1], M. OWUSU[2], H. O. FREMPONG[3] and P. AVERU[3]
[1]Kumasi Centre for Collaborative Research in Tropical Medicine, Kumasi, Ghana, [2]Komfo Anokye Teaching Hospital, Kumasi, Ghana, [3]Agogo Presbyterian Hospital, Agogo, Ghana

Corresponding Author: *Bernard Nkrumah* ***E-mails:*** *nkrumah@kccr.de*

Conflict of Interest: *None declared*

SUMMARY

Objective: To investigate the prevalence of Hepatitis B and C infections and co-infections among blood donors in a rural community of Ghana.

Design: A retrospective study.

Method: Samples of blood donated between January 2007 and December 2008 were screen for Hepatitis B and C viruses at the Agogo Presbyterian Hospital.

Results: The prevalence of Hepatitis B viral (HBV) infection was highest in females 21.4% (95% CI: 11.6-34.4) in 2006 than males in the same year 13.2% (95% CI: 10.8-15.9). Hepatitis C viral (HCV) infection was highest among males at11.6% (95% CI: 9.5-13.8) in 2007. HBV and HCV co-infection was higher in males 2.6% (95% CI: 1.6-3.8) than females 1.3% (95% CI: 0-7.0) in 2007. The overall prevalence of HBV and HCV was 13.8% (95% CI: 11.4-16.4) and 9.4% (95% CI: 7.4-11.6) respectively in 2006. The rate of co-infection of HBV and HCV however increased from 1.6% (95% CI: 0.8-2.7) in 2006 to 2.2% (95% CI: 1.3-3.2) in 2008 in males and from 0% (95% CI: 0-6.4) in 2006 to 1.2% (95% CI: 0-6.5) in 2008 in females.

Conclusion: The single infections of HBV and HCV reduced but co-infection of these transfusion transmitted infections (TTI) increased. Measures such as more sensitive techniques and education must be employed in these areas.

Keywords: Hepatitis B, Hepatitis C, blood transfusion, co-infection, blood donors

INTRODUCTION

Hepatitis B is one of most common infectious diseases of the world infecting two billion people including an estimated 400 million chronically infected cases [1]. Individuals with chronic infection have a high risk of developing liver cirrhosis and hepato cellular carcinoma. Hepatitis C virus infection is another common chronic blood borne infection with an estimated 3.9 million persons infected with the virus and has a high rate of development of liver cirrhosis. Infection by Hepatitis B virus (HBV) and Hepatitis C virus (HCV) cause serious mortality, morbidity and financial burden and are thus a major global health problem.[2] Few studies have previously indicated the high prevalence of HBV in Ghana[3,4]and pre-donation screening of blood donors or screening of donated blood for HBV and HCV are thus a routine practice. HCV is recognized as the primary cause of transfusion-associated non-A-non-B viral hepatitis worldwide[5] and is endemic in West Africa.[6]

In 1996, Martinson and his group conducted a sero-epidemiological survey of Hepatitis B and C virus infections in school children in Ashanti-Akim North district and showed that the overall HBV and HCV sero-prevalence was 15.8% and 5.4% respectively.[4] From the Biostatistics Department of the hospital, the prevalence of HBV and HCV in 2007 stood at 15.1% and 7.9% respectively (unpublished data). Information on HBV and HCV sero-prevalence in Ghana are old, scanty or limited to only urban blood donors. The study aim was therefore to determine the prevalence of HBV and HCV in blood donors in a rural area over a three-year period (2006-2008).

METHODS

Study site

The Agogo Presbyterian Hospital is located in the Asante Akim North District of the Ashanti Region of Ghana, West Africa; and is the principal hospital of the district. The District is located in the eastern part of Ashanti Region and covers a land area of 1,160 km^2 with an estimated population of 142,434 (projection from 2000 Population Census). The catchment population of the hospital encompasses around 70,000 people, about 25,000 in Agogo itself.

Study population

Between January 2006 and December 2008, Microbiology screening results from 2773 blood donors were obtained from the blood bank of the hospital. Prospective donors between the ages of 17-60 years who passed a history screen and pre-donation screening test for Hb level, HBV, HCV, Syphilis were considered fit to donate blood.

Sampling

The screening of blood donors or donated blood for HBsAg and anti-HCV is mandatory thus blood donations from individuals who are found to be positive for any of the above infections were not done. Archived results from the hospitals blood bank was used for this study with approval from the hospital authorities. The donor samples were tested using the DiaSpot® One Step Hepatitis test kits (DiaSpot Rapid Diagnosis, Pondok Kelapa 13450, Jakarta Indonesia). The tests were carried out according to the manufacturer's instructions.

Statistical analysis

Data were double-entered into a predesigned electronic database using Epi info version 6.04dfr (Center for Disease Control, Atlanta, GA, USA) and cleaned. Data was exported to Stata/SE9.0 statistical software (Stata Corporation, Texas USA) for analysis. The prevalence was calculated together with 95% confidence interval.

Ethical Approval

Ethical approval for the study was obtained from the Committee on Human Research, Publication and Ethics (CHRPE) of the School of Medical Sciences, KNUST, Kumasi.

RESULTS

A total of 2773 prospective blood donors were screened from January 2006 to December 2008. Out of this, 2556 (92.2%) were males and 217 (7.8%) were females. The donors were categorized into five age groups (Table 1). Majority of the study population, 1217 (43.9%) were in the 26 to 35 age group.

Table 1 Age categories of the study population over the study period by sex

	2006 (N=770)		**2007 (N=977)**		**2008 (N=1026)**		**Total (N=2773)**	
Age Group (yrs)	**Male**	**(%)**	**Male**	**(%)**	**Male**	**(%)**	**Male**	**(%)**
16-25	194	0.89	198	0.84	254	0.84	646	0.85
26-35	297	0.95	450	0.96	413	0.95	1160	0.95
36-45	152	0.97	183	0.93	203	0.96	538	0.95
46-55	64	0.93	61	0.94	61	0.92	186	0.93
56-65	7	0.54	8	0.80	11	1.00	26	0.76
Total	714	0.93	900	0.92	942	0.92	2556	0.92

Table 2 The overall prevalence of HBV and/or HCV infection from 2006 to 2008

	Overall Prevalence		
Year	HBV (%) (95% CI)	HCV (%) (95% CI)	Both HBV and HCV (%) (95% CI)
2006 N= 770	13.8 (11.4-16.4)	9.4 (7.4-11.6)	1.6 (0.8-2.7)
2007 N=977	11.8 (9.8-14.0)	11.1 (9.2-13.2)	2.6 (1.6-3.6)
2008 N=1026	6.9 (5.4-8.6)	7 (5.5-8.8)	2.2 (1.3-3.2)

Of the total number, 10.53% (292/2773), 5.63% (156/2773) and 2.09% (58/2773) were HBV, HCV and both HBV and HCV positive respectively.Furthermore, the prevalence of co-infection of HBV and HCV decreased from 1.6% (95% CI: 0.8-2.7) in 2006 to 2.2% (95% CI: 1.3-3.2) in 2008 (Table 2).

The overall prevalence rate for HBV was highest in 2006 (13.8%; 95% CI: 11.4-16.4) but decreased in 2008 to 6.9% (95% CI: 5.4-8.6). However, the overall prevalence of HCV was highest in 2007 (11.1%; 95% CI: 9.2-13.2) but decreased to 7.0% (95% CI: 5.5-8.8) in 2008. The prevalence rate of HBV was relatively higher in females but vice versa for HCV (Figure 1).

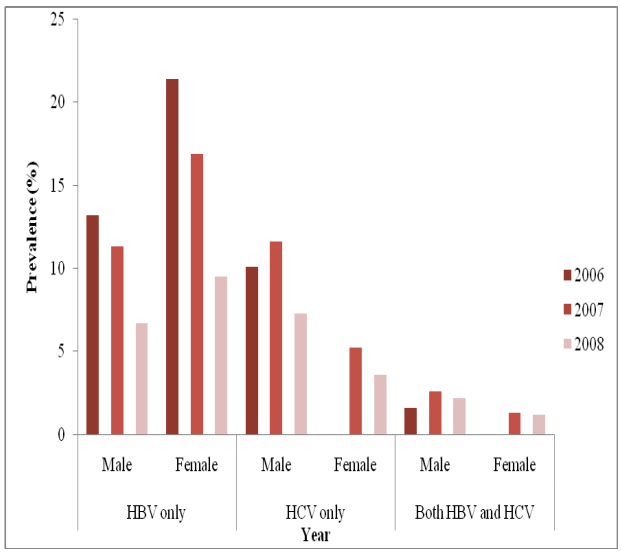

Figure 1 Prevalence of HBV and HCV infection among males and females

DISCUSSION

HBV and HCV infections occurrence among blood donors in a rural setting was determined by serological methods and the results were compared to assess the trends in three consecutive years, 2006, 2007 and 2008. The prevalence of viral carrier rates in the blood donors appears to be different to that of urban blood donors as shown in the data with a decrease in HBV and HCV. Statistics from earlier studies showed high rates of HBV and HCV in urban blood donors.[7,8]

Our study raises serious concerns regarding the safety of the blood supply in our rural communities where resources are hard to come by. The decreasing rate of positivity to HBV and HCV or both suggests that horizontal rather than vertical transmission is the major source of this endemicity.[9] In areas of low endemicity, transmission occurs primarily among young adults[10] and there is an age effect on the prevalence of HBV and HCV infections.[11] Horizontal transmission of HBV and HCV have been related to age, socioeconomic conditions, socio professional status and risky behaviours such as sharing of bath towels, chewing gum, partially eaten candies, or dental cleaning materials, as well as biting fingernails in conjunction with scratching the backs of carriers.[12-14]

It has been shown that the improvement of socioeconomic conditions may lead to a decreasing exposure to HBV and HCV infections[14] thus an increased risk of HBV and HCV infections might be related to an increased exposure to risk factors in conjunction with poor sanitary and socioeconomic conditions. The decreasing trend of HBV and HCV infections in our study population might be due to decreased exposure to risk factors in conjunction with improving sanitary and socioeconomic conditions. The fact that our study community is being educated through weekly radio health talk programmes on these diseases in terms of good life style practices such us having protected sex, not sharing razors and needles with other people among others are being adhered to.

Another possible reason might be the fact that screening of blood donors for HBsAg and anti-HCV does not totally eliminate the risk of HBV and HCV infection through blood transfusion since donors with occult HBV and HCV infection that lacked detectable levels of HBsAg and anti-HCV[15] were screened as negative. This emphasizes the need for a more sensitive and stringent screening algorithm for blood donations even in rural settings.

CONCLUSION

HBV and/or HCV infection(s) among blood donors in the study area is/are reducing. The occurrence of these infections among the blood donors should still be monitored carefully to further reduce the rates to ensure safer and more reliable blood for transfusion. Measures such as more sensitive techniques, education, sensitization and vaccination must be carried out to ensure that people are well enlightened and protected from these infections.

ACKNOWLEDGEMENTS

We wish to thank the hospital authorities for giving us the permission to use data from their archived results for this study. We sincerely thank the staff of the Agogo Presbyterian Hospital Laboratory Agogo, Asante Akim North-Ghana for their co-operation and interest in this study.

REFERENCES

1. Schreiber GB, Busch MP, Kleinman SH, Korelitz JJ. The risk of transfusion-transmitted viral infections. The Retrovirus Epidemiology Donor Study. *N Engl J Med* 1996; 334: 1685-1690.
2. Kleinman SH, Kuhns MC, Todd DS, Glynn SA, McNamara A, DiMarco A, Busch MP. Frequency of HBV DNA detection in US blood donors testing positive for the presence of anti-HBc: implications for transfusion transmission and donor screening. *Transfusion* 2003; 43: 696-704.
3. Acquaye JK, Mingle JAA. Hepatitis B viral markers in Ghanaian pregnant women. *West Afr. J. Med* 1994; 13:134–137.
4. Martinson FE, Weigle KA, Mushahwar IK, Weber DJ, Royce R, Lemon SM. Seroepidemiological survey of hepatitis B and C virus infections in

Ghanaian children. *J. Med. Virol* 1996; 48:278–283.

5. Houghton M, Weiner A, Choo QL. Molecular biology of the hepatitis C viruses: implications for diagnosis, development and control of viral disease. *Hepatology* 1999; 14:381–388.
6. Jeannel D, Fretz C, Traore Y, Kohdjo N, Bigot A, Pe Gamy E, Jourdan G, Kourouma K, Maertens G, Fumoux F, Fournel JJ, Stuyver L. Evidence for high genetic diversity and long-term endemicity of hepatitis C virus genotypes 1 and 2 in West Africa. *J. Med. Virol* 1998; 55:92–97.
7. Ampofo W, Nii-Trebi N, Ansah J, Abe K, Hideo Naito H, Aidoo S, Nuvor V, Brandful J, Yamamoto N, Ofori-Adjei D, Ishikawa K. Prevalence of Blood-Borne Infectious Diseases in Blood Donors in Ghana. *J. Clin. Microbiol* 2002; 40(9): 3523–3525.
8. Allain J-P, Candotti D, Soldan K, Sarkodie F, Phelps B, Giachetti C, Shyamala V, Yeboah F, Anokwa M, Owusu-Ofori S, Opare-Sem O. The risk of hepatitis B virus infection by transfusion in Kumasi, Ghana. *Blood* 2003; 101(6): 2419-2425.
9. Cisneros-Castolo M, Ndez-Ruiz LH, Ibarra-Robles IE, Ferna´ Ndez-GA´ Rate IH, Jorge Escobedo-DE LA Pen˜ A. Prevalence of hepatitis b virus infection and related risk factors in a rural community of Mexico. *Am. J. Trop. Med. Hyg* 2001*;* 65(6):759–763
10. Shapiro CN, Margolis HS. Hepatitis B epidemiology and prevention. *Epidemiol Rev* 1990; *12:* 221–227
11. Coleman PJ, McQuillan GM, Moyer LA, Lambert SB, Margolis HS. Incidence of hepatitis B virus infection in the United States, 1976–1994: estimates from the National Health and Nutrition Examination Surveys. *J Infect Dis* 1998; *178:* 954–959
12. Viel JF, Fest T, Dussaucy A, Pobel D, Agis F. Hepatitis B virus infection on a tropical island: sociodemographic and geographic risk factors in Guadeloupe. *Am J Trop Med Hyg* 1995; *52:* 398–402.
13. Furusyo N, Hayashi J, Sawayama Y, Kawakami Y, Kishihara Y, Kashiwagi S. The elimination of hepatitis B virus infection: changing seroepidemiology of hepatitis A and B virus infection in Okinawa, Japan, over a 26-year period. *Am J Trop Med Hyg* 1998; *59:* 693–698.
14. Martinson FEA, Weigle KA, Royce RA, Weber DJ, Suchindran CM, Lemon SM. Risk factors for horizontal transmission of hepatitis B virus in a rural district in Ghana. *Am J Epidemiol* 1998; *147:* 478–487.
15. Allain JP. Occult hepatitis B virus infection *Transfus Clin Bio* 2004; 11: 18-25.