Blood donation type and hepatitis B and C seroepidemiology at Hôpital Sominé DOLO de Mopti

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Abstract

Background: The increasing prevalence of hepatitis viral markers in developing countries results in a concern in the setting of blood transfusion safety. The aim of this study was to assess the prevalence of hepatitis viral markers among blood donors and their link with sociodemographic factors.

Methods: We performed a retrospective study on blood donors screened for HBV and HCV. HBV and HCV serologies were performed by immunochromatographic methods using Alere Determine™ HBs-Ag and SD BIOLOLINE™ HCV-Ab. Data were analyzed by R 3.4.3. The logistic regression was fitted in univariate and multivariate analysis.

Results: A total of 11,372 donors were enrolled. The overall prevalence was 10.4%. The specific prevalence of HBV and HCV were 8.9% and 1.5% respectively. The co-infection rate was 0.3%. HBV seropositivity proportion was significantly higher in family donors compared to volunteer (9.8% vs 6.0%, or = 1.71 [1.30-2.29] p < 0.001). HBV seropositivity was positively influenced by male sex aOR = 1.77 [1.4-2.26], p < 0.001 and unemployed aOR = 1.20 [1.03-1.40], p = 0.02 in multivariate analysis.

Conclusion: Our data suggest that voluntary donors and particularly female which had an occupation had a lower prevalence of hepatitis viral markers.

Keywords: Blood donation; Hepatitis; Seroepidemiology; Hôpital Sominé DOLO de Mopti.

1. Background

Hepatitis B and C virus are viral infections that spread in the liver and can result in chronic, cirrhosis and hepatocellular carcinoma disease. The virus are most commonly transmitted vertically from mother to child during birth and delivery, as well as horizontally through contact with blood or other body fluids including unsafe blood transfusion [1]. The World Health Organization (WHO) 2017 report estimated that 257 millions of people were living with chronic HBV infection, and 71 millions of people with chronic HCV infection in 2015. Hepatitis B prevalence is highest in the WHO African Region, where 6.1% of the adult population is infected [2]. The strategies adopted to lowering hepatitis prevalence include many efforts such as vaccination at birth for HBV, pregnant women and blood donors screening and treatment of cases for both HBV and HCV have paid a dividend [3]. However, these diseases still remain a major public health problem and scientific community must tighten their belts to decrease the burden of these diseases. Blood transfusion...
is not completely safe, data showed high prevalence of HBV and HCV in polytransfused patients such as patients with sickle cell disease [4]. Moreover, mathematical modeling of transfusion-transmitted viral infections (TTVI) have shown residual risks of infection in blood recipients [5-7]. Therefore, WHO calls its state members to eliminate hepatitis B and C by reducing new infections up to 90% and decrease mortality by 65% by 2030 [2]. The objective of this study was to assess the prevalence of hepatitis B and C among blood donors and to highlight the association between HBV and HCV seropositivity and sociodemographic variables.

2. Material and methods

We performed a retrospective, descriptive and analytical study of blood donation from 2011 to 2014 at Hôpital Sominé DOLO de Mopti. This study covered all volunteer and family donors which were aged between 18 and 55, weighed at least 55 kilograms, healthy, good physical condition and able to donate blood. The samples were taken by venipuncture at the level of the fold of the elbow. Approximately 2 x 2 ml of blood were taken for each donor on a dry and EDTA blood collection tubes. Viral markers research was carried out by the immuno-chromatographic methods by using Alere Determine™ HBs-Ag and SD BIOLINE™ HCV-Ab on the sera obtained after centrifugation at 1500 G for 5 minutes. We analyzed two dependent variables (HBV and HCV serological status), an independent variable (type of donation: volunteer donor or family donor) and co-variables made up of the sociodemographic status, occupational and study level. Data were recording in Microsoft Excel and analyzed by R i386 software version 3.3.4. The Pearson Chi2 test was used to compare the proportions with determination of the crude Odds Ratios (OR), their 95% confidence interval (CI) and adjusted Odds Ratios (aOR) in multivariate analysis. The Wald Chi2 p-values were used in the final model for statistical significance.

3. Results

A total of 11,372 donors were enrolled. The sex-ratio was 7.7. The age structure of donors was young one with an average of 32 ± 9 years. Blood donation was significantly familial than volunteer, 92.2% vs 7.76%, p < 0.001. Donors was essentially of male sex, 88.3% for family donors and 90.8% for volunteer donors. We fund a significant difference between family and volunteer donors by sex, p = 0.03; occupation status, p < 0.001; study level, p = 0.004; and ethnicity p < 0.001 (Table 1). The overall prevalence of viral markers was 10.4%. All of blood donors who were positive for one marker were referred to infectious diseases physician for case management. The specific prevalence of HBV and HCV were 8.9% and 1.5% respectively. The co-infection (HBV-HCV) rate was 0.3% (Figure 1). Univariate analysis show that HBV proportion of seropositivity was significantly higher in family donors compared to volunteer donors 9.8% vs 6.0%, OR = 1.71 [1.30-2.29] p < 0.001 (Figure 2 A). We did not fund no difference between family donors and volunteer donors in term of HCV seropositivity 1.90% vs 1.58%, , OR=1.20 [0.72-2.17], p = 0.6 (Figure 2 B). HBV seropositivity was positively influenced by male sex aOR 1.77 [1.4 - 2.26], p < 0.001 and unemployed aOR=1.20 [1.03- 1.40], p = 0.02 in multivariate analysis (Table 2). None of the sociodemographic factors studied had any impact on HCV seropositivity.

Figure 1 The overall prevalence of viral markers in blood donors.
HBV = Hepatitis B Virus, HCV = Hepatitis C Virus, HIV = Human Immunodeficiency Virus
Figure 2 Association of hepatitis markers and blood donation type in univariate analysis.

FD = Family Donors, VD = Volunteer Donors, OR = Odd Ratio.

Table 1 Sociodemographic characteristics of blood donor types.

| Variables                              | Family Donor | Volunteer Donor | p     |
|----------------------------------------|--------------|-----------------|-------|
| N                                      | 10,489       | 883             | < 0.001|
| Percentage                             | 92.24        | 7.76            |       |
| Man (%)                                | 88.35        | 90.83           |       |
| Woman (%)                              | 11.65        | 9.17            |       |
| = 18 years (%)                         | 1.6          | 0.9             | 0.03  |
| [19-29 years] (%)                      | 38.6         | 35.8            | 0.09  |
| [30-39 years] (%)                      | 35.0         | 37.3            |       |
| ≥ 40 years (%)                         | 24.8         | 26.0            |       |
| Mopti region (%)                       | 97.32        | 98.19           | 0.15  |
| Outside Mopti (%)                      | 2.68         | 1.81            |       |
| With occupation (%)                    | 46.9         | 59.5            |       |
| Students (%)                           | 9.0          | 7.7             |       |
| Unemployed (%)                         | 44.1         | 32.8            | < 0.001|
| Non-literate or primary education level (%) | 74.6       | 70.0            |       |
| Secondary education level (%)          | 18.1         | 20.2            |       |
| High education level (%)               | 7.3          | 9.8             | 0.004 |
| Fulani                                 | 22.8         | 20.1            |       |
| Bozo                                   | 17.4         | 16.6            |       |
| Dogon                                  | 19.1         | 15.7            |       |
| Sonraï                                 | 10.9         | 9.2             |       |
| Bambara                                | 21.9         | 30.4            |       |
| Others                                 | 7.9          | 8.0             | < 0.001|
Table 2 Adjusted Odd Ratio (aOR) and 95% CI, of the HBV serology result according to the type of blood donation in multivariate analysis.

| Variables       | N   | aOR                  | p       |
|-----------------|-----|----------------------|---------|
| Donation        |     | Reference            |         |
| FD              | 10,482 | 0.59 (0.44, 0.77) | <0.001  |
| VD              | 879  | Reference            |         |
| Sex             |     | Reference            |         |
| Man             | 10,056 | 1.69 (1.34, 2.15) | <0.001  |
| Woman           | 1,350 | Reference            |         |
| Age classes     |     | Reference            |         |
| [18 years]      | 182  | Reference            |         |
| [19-29 years]   | 4,364 | 1.22 (0.73, 2.17) | 0.48    |
| [30-39 years]   | 3,996 | 1.12 (0.67, 2.00) | 0.04    |
| [≥ 40 years]    | 2,819 | 0.96 (0.57, 1.72) | 0.88    |
| Ethnic          |     | Reference            |         |
| Others          | 899  | Reference            |         |
| Bambara         | 2,557 | 1.15 (0.88, 1.52) | 0.32    |
| Bozo            | 1,976 | 1.33 (1.01, 1.71) | 0.05    |
| Dogon           | 2,136 | 1.40 (1.07, 1.86) | 0.01    |
| Fulani          | 2,568 | 1.05 (0.80, 1.39) | 0.75    |
| Sonrhai         | 1,225 | 1.13 (0.84, 1.54) | 0.43    |
| (Intercept)     |     | 0.05 (0.03, 0.09)   | <0.001  |

N = Number, aOR = adjusted Odd Ratio, FD = Familial Donors, VD = Volunteer Donor.

4. Discussion

Transfusion safety involves screening of viral markers in both family and volunteer donors. The difference of seroprevalence of these markers between family and volunteer donors has been the subject of much controversy [8-10]. However, it is generally accepted that regular volunteer donors have a lower seroprevalence compared to replacement or family ones [11-13]. In our study, family donors were significantly higher than volunteer donors 92.24% vs. 7.76% p < 0.001. This data suggests that blood donation is still family-based in our hospital instead of volunteer donations which have been promoted by the World Health Organization [14-15]. However, Asenso-Mensah K and al, in 2014 and Allain JP and al, in 2016 by adjusting for age and sex showed that there was no difference in risk of transfusion transmitted infection between family and first time volunteers donors. They concluded that the exclusion of family donors would be illegitimate and harmful for the availability of the blood product in resource-limited countries [16-17]. We found a significant difference between family and volunteer donors in terms of sex p = 0.03. Male sex was more likely to be blood donor than woman 88.35% vs 11.65%. This could be explained by the existence of many contraindications to blood donation in woman than in man. Moreover, there were more male volunteers donor than family donors, and women were more likely to be in the family donor category than volunteer. These could be linked to the many contraindications in women[18-19]. The distribution of donors in the two categories was significantly different for occupational status and level of education. More donors in the volunteer donor category were more likely to be workers. On the other hand, pupils, students and the unemployed were better represented in the family donor category p < 0.001. Non-literate and primary education level donors were more represented in the family donor category, while those with secondary and higher education levels were more represented in the volunteer donor category p = 0.004. These could be explained by the higher resilience of working donors and those with a secondary and higher education level compared to other donors. These findings are similar to studies conducted by Thompson WW and al, in the United States and Tavakol N and al, in Iran, who have shown the importance of education and professional status in the propensity to donate blood and even to becoming regular volunteer donors [20-21]. The overall seroprevalence in blood donors was 10.4%. The specific prevalence of the hepatitis B virus surface antigen (HBs-Ag) and the hepatitis C virus antibody (HCV-Ab) were respectively 8.9%, and 1.5%. The co-infection HBV and HCV proportion was 0.3%. Proportionally, our results are lower than those obtained by Diarra A and al, 2007 at the National Center of Blood Transfusion of Bamako, who found a prevalence of 13.9% and 3.3% respectively for HBV-Ag and HCV-Ab [22]. Moreover, Koné MC and al, 2012 have found relatively lower prevalences in donors at Hôpital Nianankoro Fomba of Ségou, ie 5.3% and 0.5% respectively for HBs-Ag and HCV-Ab [23]. The trend of high prevalence of viral...
markers in blood donors in developing countries such as ours has been reported in several studies in West and Central Africa. This is the case for Mayaki Z and al., 2013 in Niger, who found a prevalence of 15.5%, and 1.2% respectively for HBs-Ag and HCV-Ab among donors in Niamey [24]. Buseri F and al., 2009 reported a prevalence of 18.1% and 6.0% respectively for HBs-Ag and HCV-Ab in Nigeria [25]. In Central Africa, Ankouane F and al., 2016, found a prevalence of 12.6% and 3.2% respectively for HBs-Ag and HCV-Ab in Cameroon [26] while Nambei WS and al., 2016 found 8.9% and 4.72% respectively for HBs-Ag and HCV-Ab [11]. However, lower prevalences have been reported by Offergeld R and al., 2012 in Germany, Sommese L and al., 2014 in Italy and Sehgal S and al., 2017 in Island; showing thigh disparity in the prevalence of viral markers between rich, middle and low-income countries [27-29]. The distribution of viral markers was significantly different in the two donor groups. Indeed, univariate analysis revealed that the risk of having a positive viral marker was 1.71 times [CI = 1.30 To 2.29], p < 0.001 for HBs-Ag in family donors than in volunteer donors. Many studies have shown higher seroprevalence of HBV-Ab among family donors than volunteers. This is the case for Mole S and al., in 2011 in Cameroon and Tounkara A and al., in Mali [30-31]. However, as Diarra A and al., we did not found difference of having positive HBV-Ag between family and volunteer donors OR = 1.20 [CI = 0.72 to 2.17], p = 0.6 for. Multivariate analysis showed a positive association between male sex aOR= 1.69 [1.34-2.15], p < 0.001; Dogon ethnic aOR=1.40 [1.07-1.86], p = 0.01 and Bozo ethnic aOR= 1.33 [1.01-1.76], p = 0.05 and HBV-Ag seropositivity. Volunteer donors was negatively associated to HBV-Ag seropositivity aOR = 0.59 [0.44-0.77], p < 0.001.

5. Conclusion

Our data suggest that female voluntary donors with secondary or higher education level had a low prevalence of viral markers. An incentive scheme of awareness should be conducted among low-educated and unemployed male blood donors to let them become a regular volunteer with a high level of resilience and low-risk behavior in order to reduce HBV-Ag and HCV-Ab seroprevalence in blood donors.

Compliance with ethical standards

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Disclosure of conflict of interest

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Statement of informed consent

Each participant gave fully informed written consent prior to enrollment. The protocol was reviewed and approved by the Faculty of Pharmacy and Hospital.

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