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Original Article

Epidemiological Aspects of Hepatitis B and C Markers in Blood Donors in Kazakhstan; 2000-2011

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Abstract

Background: Transfusion-transmissible infections such as hepatitis B and hepatitis C are among the greatest threats to blood safety for transfusion recipients and pose a serious public health problem. The aim of this study was to assess the epidemiological aspects of hepatitis B and C in Kazakhstani donor's blood over the period 2000-2011.

Methods: The data were obtained from the annual reports of the Republican Blood Center. The retrospective study was conducted from 2000 to 2011.

Results: Over the study period in the republic a growth of volumes of procured blood from 312.4 to 398.0 units was noted, in total equaled to 4,277.8 units. The proportion of blood wasted increased from 8.3% to 8.7%. In the dynamics the proportion of viral hepatitis among all causes of blood wasted decreased from 29% to 15.5% (HBV) and from 33.5% to 9.9% (HCV). The proportion of HBV and HCV in whole blood decreased considerably, in plasma and red cell concentrate the rates changed slightly. The average annual prevalence of HBV and HCV were 2.1% and 1.8%, respectively.

Conclusion: Despite the reduction of viral hepatitis rates among blood donors in Kazakhstan the prevalence still remains high. The HBV prevalence is higher compared to HCV, which needs further investigations in the general population to address the issue.

Keywords: Blood donors, Hepatitis B virus, Hepatitis C virus, Kazakhstan

Introduction

Blood donations save millions of lives. However, unsafe transfusion practices put millions of people at risk for transfusion-transmissible infections (TTIs) (1). Indeed, with every unit of blood, there is a residual risk to become infected with a TTI agent, including mainly hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), and syphilis (2). The first association of hepatitis with blood transfusion was in 1943 (3). Today HBV infection is one of the most spread infections. Approximately 2 billion of world's population has been infected and about 400 million (5% of the world's population) have chronic infection, more than 50 million people infected annually (4, 5). HCV infection is another common chronic infection, averaging 2-3% or 200 million persons globally (6, 7). Despite the significant reduction of the infection transmission risk

over the past 20 years due to the selection of blood donors with low TTI marker risk followed by effective laboratory screening (8, 9), the risk of TTIs still remains a major concern (10).

Kazakhstan is a post-Soviet newly independent country located in Central Asia, divided into 16 geographical-administrative areas (14 regions and the cities of Astana and Almaty). Blood safety in the republic in respect of transmission of infectious diseases is safeguarded by legislation that prescribes the selection of donors, both by predonation questioning and serological testing. In accordance with international requirements, blood donors undergo mandatory screening tests for the presence of antibodies to HCV, HIV and syphilis, and HBV antigen. Donors who are reactive and/or positive are deferred and excluded (11).

Another way of ensuring blood safety is identification and retention of healthy blood donors (12), especially regular voluntary non-remunerated low-risk donors (13). In most developing and transitional countries family/replacement and paid blood donors are still a significant source of blood for transfusion (14). However, the possibility of contracting hepatitis is much higher among family/replacement donors (15-17), and paid donors (18).

The objective of this study was to assess the epidemiological aspects of Hepatitis B and C in donor's blood over the period 2000-2011.

Materials and Methods

The annual reports on the blood donations in the republic (form N39) compiled by the Republican Blood Center were extracted from the database of the Ministry of Health of the Republic of Kazakhstan. The data on the prevalence of HBV and HCV among donor's blood were obtained. Data of the Agency of Statistics on the population of Kazakhstan and on the incidence of viral hepatitis were used (19). The time frame covers the period from 2000 to 2011.

Our study describes the prevalence of hepatitis in whole blood, as well as in red cell concentrate and plasma, which are produced by method of plasmaphoresis and cytaphoresis (20). After collecting a whole blood a small portion of it is left, the majority is processed in blood components.

According to the law of the Republic of Kazakhstan «About State Statistics» (21), the information in the summary report is confidential and may only be used for statistical purposes. The information may be shared for research purposes only if a requesting organization provides the data security and undertakes all the necessary actions in making unable the identity of respondents, in concordance with the Principles of the World Medical Association (WMA) Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects, adopted by the 18th WMA General Assembly in Helsinki, Finland, in June 1964.

In the study different methods of biomedical statistics were used – extensive and intensive indexes, average value, mean error, 95% confidence interval and the average annual growth/decline rate (T, %) (22). The method of map compiling was used, based on the calculation of the standard deviation (σ) from the mean (x) (23). When grouping a parametrical row for modeling equal intervals the formula proposed by Boyarsky (24) was used.

Data collection and analysis was achieved by compiling the data on Microsoft Excel computing program and BIOSTAT for Windows (Version 4.03 by Glantz).

Results

Between 2000 and 2011 in the republic a growth of volumes of procured blood from 312.4 to 398.0 units was noted, in total equaled to 4,277.8 units. The proportion of blood wasted also increased from 8.3% to 8.7%.

While the proportion of HBV and HCV among all blood discarded has decreased (Fig. 1). The average annual proportion of HBV was 25.0±2.0 (95% CI=21.0-29.0), of HCV 21.3±2.6 (95% CI=16.2-26.5).

According to the data of the Agency of Statistics the hepatitis are not differentiated according to types.

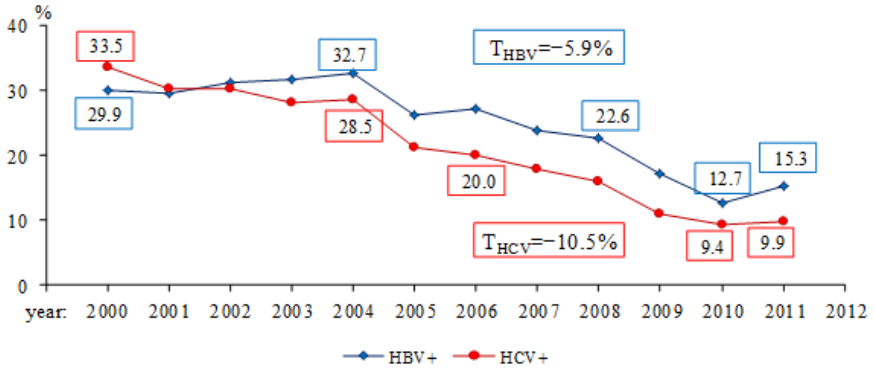

Fig. 1: The proportion of hepatitis B and C in the total number of blood wastes for 2000-2011/ HBV+, positive test for hepatitis B antigen, HCV+, reactive/positive antibody test for hepatitis C

Therefore, we considered the incidence of all types of viral hepatitis per 100,000 populations in whole over the country for 2000-2011. A significant decrease from 185.6 to 16.2 was found. The regional features of the hepatitis distribution are shown in Table 1. The viral hepatitis incidences were grouped into three clusters (Fig. 2).

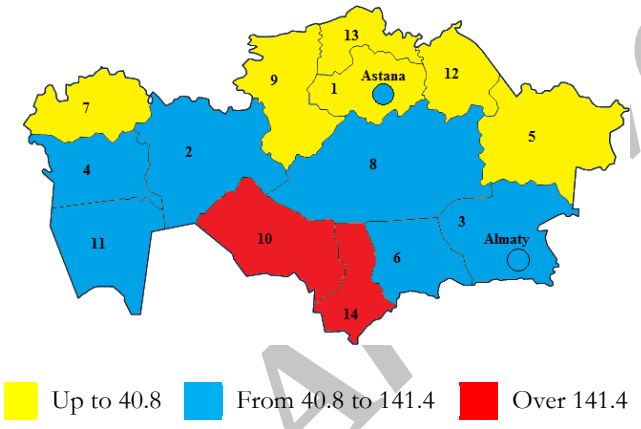

Fig. 2: The map of all viral hepatitis incidence per 100,000 population in Kazakhstan for 2000-2011. Regions: 1. Akmola, 2. Aktobe, 3. Almaty, 4. Atyrau, 5. East-Kazakhstan, 6. Zhambyl, 7.West-Kazakhstan, 8. Karaganda, 9. Kostanay, 10.Kyzylorda, 11. Mangistau, 12. Pavlodar, 13. North-Kazakhstan, 14. South-Kazakhstan

The total number of blood positive for TTI markers was 99,430 (5.2±0.4%) (95% CI=4.4-6.1). Among them the overall seroprevalence of HBV and HCV were 2.1±0.2% (95% CI=1.8-2.4) and 1.8±0.2% (95% CI=1.2-2.2) respectively.

The annual decline rates were −5.4% and −10.0%, respectively. Between 2000 and 2011 the HBV prevalence rate decreased from 2.5% to 1.3%, HCV prevalence rate also decreased from 2.8% to 0.9%. The proportion of HBV and HCV in whole blood, plasma and red cell concentrate are illustrated in Fig. 3. Decline/growth rates of HBV were −31.6% (whole blood), +0.8% (plasma) and −0.8% (red cell concentrate), for HCV −31.5%, −4.4% and −5.7%, respectively.

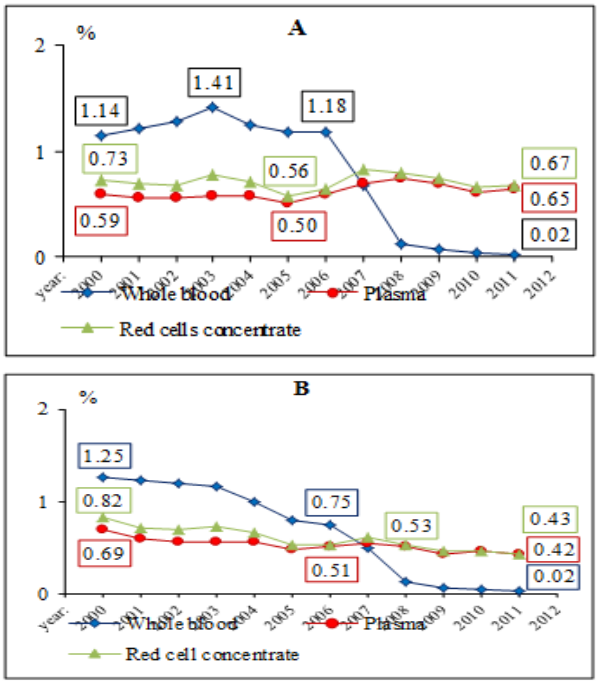

Fig. 3: The dynamics of hepatitis B (A) and hepatitis C (B) revealed in whole blood, plasma and red cell concentrate from 2000 to 2011

Table 1: The average annual incidence rate of viral hepatitis per 100,000 population in the Republic of Kazakhstan for 2000-2011 years

Region/ city	M±m	95% CI	T, %
Pavlodar	19.1±6.5	6.5-31.8	−23.5
West Kazakhstan	22.0±7.5	7.3-36.6	−22.7
North Kazakhstan	29.9±8.5	13.2-46.7	−24.3
Kostanay	32.5±7.2	18.4-46.7	−18.5
Akmola	34.0±7.5	19.4-48.6	−16.1
East Kazakhstan	37.1±6.8	23.7-50.4	−17.4
Aktobe	47.4±12.7	22.4-72.3	−23.4
Atyrau	49.5±21.4	7.6-91.3	−27.5
Astana city	56.8±11.2	34.8-78.7	−17.5
Karaganda	58.0±11.5	35.5-80.5	−16.2
Almaty region	59.1±11.9	35.9-82.4	−14.5
Almaty city	64.4±15.6	33.8-94.9	−20.3
Mangistau	77.0±36.4	5.7-148.2	−31.3
Zhambyl	104.2±21.5	62.1-146.3	−20.9
South Kazakhstan	179.7±30.8	119.3-240.0	−21.5
Kyzylorda	185.1±47.3	92.3-277.8	−21.5
Republic of Kazakhstan	74.5±14.3	46.4-102.6	−19.9

Discussion

The objective of our study was to evaluate the prevalence of HBV and HCV in Kazakhstani blood donors. The average annual rate of HBV in this study was 2.1%, which is slightly lower when compared 2.58% found by Fessehaye et al. (25) in Eritrean donors, 4.7% in Pakistani donors and 15% in Egypt (26). However this index was higher than 0.20% found by Cheraghali in Iranian donors (27) and 1.1% found by Ejele et al.(28) in Niger delta region of Nigeria.

The average annual prevalence rate of HCV was equal to 1.8%, and this is high when compared to 0.57% in Eritrea (25), 0.2% in Kenya (29) and 0.06% in Iran (27). The prevalence was higher than values ranging between 0.072% and 0.6% reported from the USA and Albania (30, 31) but lower when compared to 2.7% in Egypt (32).

In blood transfusion centers a small portion of the whole blood is left, and the rest is processed in the blood components (red cells concentrate, plasma etc.). According to the reporting form N39 the presence of HBV and HCV are defined both in whole blood and in its components. Over the study period the HBV seroprevalence in whole blood showed a considerable decreasing trend from 1.14% to 0.02%. In the red cell concentrate fraction the HBV slightly changed from 0.73% to 0.67%, whereas in plasma an increase from 0.59% to 0.65% was noted. The aligned HCV prevalence rates had steadily decreased in whole blood, red cell concentrate and plasma from 1.25% to 0.02%, from 0.82% to 0.43% and from 0.69% to 0.42%, respectively (Fig. 3). The reduction in the presence of hepatitis virus markers in whole blood and slight changes in plasma and red cell concentrate, are probably due to the fact that in recent years whole blood transfusion is reducing, blood component therapy is preferred and therefore most TTIs are revealed there.

Regionally the lowest incidence rates of viral hepatitis in Kazakhstan were found in Pavlodar (19.1±6.5; 95% CI=6.5-31.8) and West Kazakhstan (22.0±7.5; 95% CI=7.3-36.6) regions. The highest rates were found in the South Kazakhstan (179.7±30.8; 95% CI=119.3-240.0) and Kyzylorda (185.1±47.3; 95% CI=92.3-277.8) regions. The incidence of viral hepatitis in the regions with low and high levels were significantly different (P<0.05). The objective causative-factor differences that effected the indicators, may possibly

relate to the accounting and registration questions, the preventive measures, the establishment of cause-effect relationship, and with other economic, medical-social, medical-geographical features in different regions of Kazakhstan.

The epidemiological assessment of hepatitis rate over 12 years in donor's blood showed a considerable reduction. However, the prevalence of TTIs among blood donors in Kazakhstan still has an important focus of attention. The reduction of the TTI markers can be achieved by truly reliable information about the health condition of both repeat and first time donors, involvement of preferably voluntary non-remunerated blood donors, comprehensive standardized screening of blood which are paramount for the organization of the most effective blood transfusion service (33, 34).

Conclusion

The prevalence of hepatitis among donor's blood in Kazakhstan still remains a major concern for the blood transfusion service. The HBV prevalence is higher compared to HCV and this needs further investigation including studying the prevalence rate of HBV in the general population to address the issue. The decreasing prevalence rate of HCV among Kazakh donors is an encouraging signal, which indicates the effectiveness of the changes introduced in the National Blood Transfusion Service in line with the Ministry of Health and WHO strategy for blood safety.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

Acknowledgments

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