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A TEN-YEAR TREND OF HUMAN IMMUNODEFICIENCY VIRUS INFECTION IN VOLUNTARY BLOOD DONORS IN THE SOUTH BAČKA DISTRICT OF VOJVODINA

DESETOGODIŠNJI TREND INFEKCIJE VIRUSOM HUMANE IMUNODEFICIJENCIJE KOD DOBROVOLJNIH DAVALACA KRVI U JUŽNOBAČKOM REGIONU VOJVODINE

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Summary

Introduction. The first cases of human immunodeficiency virus infection and the first transmission of human immunodeficiency virus infection through blood transfusion in Vojvodina were registered in 1985. The aims of this study were to determine the ten-year trend of human immunodeficiency virus infection among blood donors in South Bačka District of Vojvodina, routes of transmission and risk factors. **Material and Methods.** A retrospective study was conducted at the Blood Transfusion Institute of Vojvodina during 2009 - 2018, and human immunodeficiency antigens and antibodies were analyzed. A total of 300 936 blood donor samples were screened using combined antibody-antigen tests (fourth generation enzyme-linked immunosorbent assay and chemiluminescence). Further testing included confirmatory immunoblot assay and molecular assay. **Results.** The overall human immunodeficiency virus seroprevalence was 3.7 per 100 000 donations. The number of blood donors found to be human immunodeficiency virus positive has increased during the study period showing a positive trend. The highest number of human immunodeficiency virus positive results was reported among blood donors aged 26-35 (36%) and 46-55 years (27%). The infection was more frequent in males. The leading route of transmission was through unprotected sexual intercourse. Higher human immunodeficiency virus prevalence was among regular blood donors (73%). **Conclusion.** This study points to the importance of careful selection of blood donors and their education about risk behavior in order to reduce the risk of human immunodeficiency virus transmission. Concomitant use of sensitive serological and molecular tests is crucial to increase the blood safety.

Key words: Blood Donors; HIV Seroprevalence; HIV Infections; Risk Factors; Blood Transfusion; Blood Safety; Donor Selection; Sexual Behavior

Introduction

The first cases of human immunodeficiency virus (HIV) were reported in 1981 in the United States in apparently healthy men. The patients were diagnosed with Pneumocystis jiroveci pneumonia or Kaposi's sarcoma, which are commonly associ-

Sažetak

Uvod. Prvi slučajevi infekcije virusom humane imunodeficijencije u Vojvodini registrovani su 1985. godine kada je registrovan i prvi prenos infekcije virusom humane imunodeficijencije putem transfuzije krvi. Cilj studije bio je da se utvrdi desetogodišnji trend infekcije virusom humane imunodeficijencije kod dobrovoljnih davalaca krvi Južnobačkog okruga Vojvodine, način prenosa infekcije i faktori rizika. **Materijal i metode.** U retrospektivnoj studiji analizirani su rezultati kombinovanog testiranja antigena i antitela na virusu humane imunodeficijencije kod davalaca krvi u Zavodu za transfuziju krvi Vojvodine u periodu od 2009. do 2018. godine. Za testiranje 300.936 uzoraka krvi davalaca krvi korišćeni su testovi četvrte generacije imunoenzimskih testova i testovi hemiluminiscencije. Dodatno testiranje uključivalo je potvrdni imunoblot test i molekularno testiranje. **Rezultati.** Ukupna prevalencija infekcije virusom humane imunodeficijencije iznosila je 3,7 na 100.000 jedinica krvi. Broj davalaca krvi pozitivnih na virus humane imunodeficijencije povećavao se tokom perioda studije (pozitivan trend). Najveći broj davalaca krvi pozitivnih na virus humane imunodeficijencije registrovan je u uzrastima 26–35 (36%) i 46–55 godina (27%). Infekcija je češće registrovana kod muškaraca. Vodeći način prenosa infekcije bio je putem nezaštićenog seksualnog odnosa. Utvrđena je viša prevalencija infekcije kod višestrukih davalaca krvi (73%). **Zaključak.** Studija prikazuje značaj koji pravilna selekcija davalaca krvi i njihova edukacija o rizičnom ponašanju imaju na smanjenje rizika prenosa infekcije virusom humane imunodeficijencije. Istovremena upotreba osetljivih seroloških i molekularnih testova ključna je za povećanje bezbednosti transfuzije krvi.

Ključne reči: donori krvi; HIV seroprevalencija; HIV infekcije; faktori rizika; transfuzija krvi; sigurnost krvi; izbor donora; seksualna aktivnost

ated with weakened immune system. The unknown disease was called acquired immunodeficiency syndrome (AIDS), but very soon the cause was discovered and it was HIV [1]. Initially, it was thought that the virus affected only "risk groups" of population, such as men who have sex with men (MSM), intravenous drug users, patients on dialysis, as well as

Abbreviations

HIV	– human immunodeficiency virus
MSM	– men who have sex with men
BD	– blood donor
BTIV	– Blood Transfusion Institute of Vojvodina
NAAT	– nucleic acid-amplification testing
WHO	– World Health Organization

patients receiving blood transfusions [2]. The first case of transfusion-transmitted HIV infection was reported in late 1982, in the United States, while the first HIV antibody test was introduced in March of 1985, as a part of a routine screening of the donated blood [3]. The first cases of HIV infection and transfusion-transmitted HIV infection in Vojvodina were registered in 1985 [4].

Although a great progress has been made in the treatment of persons with HIV infection and in the prevention of HIV transmission through blood, there still remains a residual risk [5, 6]. Continuous, efficient, timely, reliable, and safe blood supply of health facilities represents the basis of the strategy of developing a good health care system in every country. A well-organized transfusion service with high quality level of each process, starting with the selection of blood donors (BD), blood collection, processing, storage, testing and distribution are prerequisites to achieve this aim [7]. According to the Law of Transfusion Medicine in Serbia, screening of all blood donations to blood-transmissible diseases (HIV I/II, hepatitis B and C and syphilis) is mandatory [8].

The aims of this study were to determine the HIV infection ten-year trend in BDs in the South Bačka District of Vojvodina, demographic characteristics of HIV positive BDs, routes of transmission and risk factors in low-risk donors as factors that may affect the transmission of the virus through blood transfusion.

Material and Methods

This retrospective observational study analyzed the results of HIV tests performed among BDs in the South Bačka District of Vojvodina from January 2009 to December 2018. Data were collected from the monthly reports and Donor Deferral Registry of the Blood Transfusion Institute of Vojvodina (BTIV).

A specially designed blood donor questionnaire, including questions about risky behaviors and the donors' health status, was used to collect data from BDs before donating blood. A BD was selected to donate blood after he or she passed eligibility criteria according to the Law of the Transfusion Medicine in Serbia (medical history, physical examination, pulse, blood pressure, hemoglobin level etc.).

A total of 300 936 blood samples of all donated blood were screened using the fourth generation of the enzyme-linked immunosorbent assay (ELISA) (BioRad Geenscreen Ultra HIV I/II Ag/Ab) and Chemiluminescent immunoassay (Abbott Architect HIV I/II Ag/Ab Combo; Siemens Advia Centaur HIV I/II Ag/Ab Combo Assay) for the detection of

HIV antigens and HIV antibodies, which could detect HIV between 13 and 24 days after exposure (window period).

In case of repeatedly reactive results, the sample was tested by confirmatory immunoblot assay (Fujirebio Inno-Lia HIV I/II Score) at the BTIV. In confirmed HIV-positive BDs, their stored blood samples from the last donation were thawed and tested by immunoassay and nucleic acid-amplification testing (NAAT) for presence of HIV markers.

All BDs with positive results for HIV who confirmed positive using an immunoblot assay were invited to a confidential interview at the BTIV and their initial questionnaire was reviewed. After they were informed about their positive results and about possible ways of HIV transmission, they were encouraged to inform their partners who should also be tested, and were referred to the HIV Counseling Center of the Institute of Public Health of Vojvodina. They were also referred for further examination and additional molecular testing for HIV at the Clinic of Infectious Disease of the Clinical Center of Vojvodina.

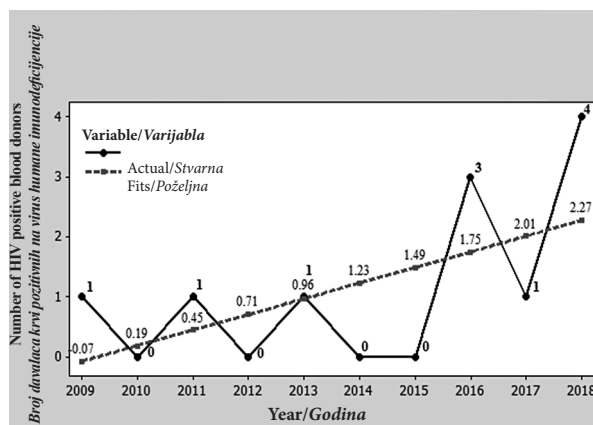
Test results were statistically analyzed by Minitab® 16 Statistical Software.

Results

During the study period a total of 300 936 blood samples were tested, from 14 714 to 20 983 per year. Among these samples, 11 were found positive with prevalence of 3.7 HIV infections per 100.000 blood donations. Although there was a small number of positive cases, the trend of HIV infection among BDs increased between 2009 - 2018 (**Graph 1**).

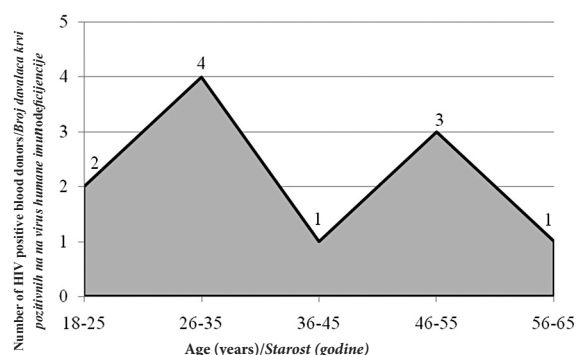
The highest number of HIV positive results was reported among BDs aged 26 - 35 (36%) and 46 - 55 years (27%) (**Graph 2**). HIV infection was more frequently detected in males (91%).

Out of all HIV positive BDs, 3 (27%) were first time BDs, while 8 (73%) were regular BDs. In six



Graph 1. Trend of HIV infection in blood donors in the South Bačka District of Vojvodina, 2009 – 2018

Grafikon 1. Trend infekcije virusom humane imunodeficijencije kod davalaca krvi u Južnobačkom okrugu 2009–2018



Graph 2. Age distribution of HIV positive blood donors in the South Bačka District of Vojvodina, 2009 – 2018

Grafikon 2. Starosna distribucija davalaca krvi pozitivnih na virus humane imunodeficijencije u Južnobačkom okrugu, 2009–2018

regular BDs the time period between the last donation and the HIV positive donation was longer than one year, while two regular BDs gave blood every three months. For all of the regular BDs, the stored blood samples from the last donation screened negative, while one blood sample was NAAT positive. The BD with NAAT positive result at previous donation donated blood three months before and transmitted HIV virus through blood transfusion, as the consequence of the “window period”.

The majority of HIV positive BDs (81.8%) were from the city of Novi Sad.

The leading mode of transmission (91%) was through unprotected sexual intercourse: transmissions from MSM in 54.6%, and heterosexual mode in 36.4% of cases. In 9% of BDs, the mode of transmission could not be determined. The review of the BD questionnaire showed that all BDs denied risk behavior.

Discussion

The study identified the highest number of HIV infections among male BDs aged 26-35 (36%) and 46-55 (27%), from urban environment, regular BDs with year or more since the last blood donation. The infection occurred through unprotected sexual intercourse in the majority of cases, mainly in MSM. All infected BDs denied any form of risk behaviors in the BD questionnaire.

In the latest report published by the European Centre for Disease Prevention and Control and the World Health Organization (WHO) Regional Office for Europe, HIV transmission remains a major public health concern. The HIV affects more than 2 million people in the WHO European Region, particularly in the eastern part of the Region. Nearly 160 000 people were diagnosed with HIV in the European Region in 2017. The increasing trend in newly diagnosed HIV infections continued for the Region overall [9]. Countries with the lowest rates were Slovenia (1.9) and Slovakia (1.3), and Lithuania (18.8) and Estonia (16.6) with the highest rates [10].

According to the report of the Institute of Public Health of Vojvodina, with an average of 41 newly identified cases in the total population per year, Vojvodina's population belongs to the group of low rate HIV infections with approximately two newly diagnosed HIV infections per 100 000 inhabitants. In the period from 1985 to 2017, the transmission of HIV infection through blood transfusion in Vojvodina presents 0.5% of all HIV transmission modes [11].

The prevalence of HIV positive BDs in Europe is 8.9 per 100 000 donations: 1.8 in Western Europe and 37.6 in Eastern Europe [12]. In our study, the prevalence of HIV was 3.7 per 100 000 donations in the territory of the South Bačka District of Vojvodina, which means it has a higher prevalence of HIV positive BDs than western European countries. This group also includes Italy (3.8), Spain (6.0) and countries of the Central Europe (3.8) [10, 12]. It is evident that there were no cases of HIV infected BDs in the four observed years. Also, it is important to emphasize that at the end of 2015, the prevalence of HIV positive BDs in the South Bačka District of Vojvodina was considerably lower than later. It can be concluded that blood transfusion still remains a potential risk for the transmission of viral infections, including HIV. The high cost of antiretroviral therapy and potential late diagnosis may potentially lead to increased morbidity and mortality among infected persons.

The study shows that there was an increase in newly diagnosed cases of HIV among BDs, and the highest number of HIV infected BDs was identified in 2018. All infected BDs diagnosed during 2018 donated blood in the territory of the municipality of Novi Sad.

Since August 2019, the new Law on Transfusion Medicine has introduced NAAT as part of the mandatory screening of donated blood in Serbia [8]. Implementation of NAAT testing will reduce the risk of transfusion-transmitted viral infections, because it can detect viremia earlier (approximately within 11 days) than current screening methods [13]. With reducing the “window period” by using NAAT, the safety of blood products will increase.

Although HIV infection is usually discovered in first-time donors, who are not fully aware of the risk factors that can lead to transmission of infection, this study found something different [14]. Namely, among the BDs with confirmed HIV infection, regular BD were more frequent than first-time BDs. During the post-testing interview with the doctor, not one of the blood donors suspected that he was infected, but all of them were aware of their risk behavior that could lead to the transmission of HIV infection. The dishonest or misleading answers in the donors questionnaire could have been conscious or unconscious, as a result of two reasons: they did not suspect that they were infected, or they wanted to be tested. Fearing stigma and discrimination, they donated blood and they were tested for sexually transmitted diseases in a way that allowed them to avoid people to know about their lifestyles and

risk behaviors. This is supported by the fact that the largest number of infected BDs was from the group of men who were infected through sexual relations with other men. In Serbia, BDs with such sexual orientation are permanently excluded from blood donation, which confirms the fact that they knowingly avoided to be honest and accurately fill out health questionnaires. Most European countries also permanently decline BDs who are MSM [15]; Hungary, Slovakia and United Kingdom defer them temporarily for three to six months [16], while Spain and Italy have no restrictions for MSM [17].

One of the main reasons why Vojvodina is a region with a low incidence of newly diagnosed HIV infections is the low rate (11.2) of HIV testing per 1,000 people in Vojvodina [18], compared to the countries of the European Union (e.g. France has a rate of testing 80.6.) [19]. On the other hand, a large number of the tested persons in Vojvodina belong to BDs. For example, during 2016, a total of 79 389 HIV tests were performed in Vojvodina, while 57 741 (72.7%) of them belonged to BDs [18].

Conclusion

This study shows the importance of proper selection of blood donors, application of sensitive screening tests, and nucleic acid amplification testing for preparation of safe blood units and blood products. Providing more privacy for blood donors when filling out the questionnaire and education focused on all the possible consequences of failure to report "risk behavior", may contribute to lower prevalence of human immunodeficiency virus infection in the population of blood donors. Sufficient information about human immunodeficiency virus infection allows blood donors "self-exclusion" from the process of blood donation in case of risk factors and reduce the residual risk of transmitting the virus in the "window period". It is also important for potential blood donors to be informed about the possibility of confidential counseling and anonymous and free of charge human immunodeficiency virus testing daily at the Counseling Center of the Institute of Public Health of Vojvodina.

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