

Investigation on HTLV Infection among Voluntary Blood Donors in Wuzhou City

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ABSTRACT

Objective: To understand the infection of HTLV among voluntary blood donors in Wuzhou City, and to provide reference for the national health administrative department to formulate blood safety screening strategies. **Methods:** The HTLV double-antigen sandwich ELISA reagent was used to screen the blood samples of unpaid blood donors, and the reactive samples in the initial screening were subjected to a double-well retest; Specimens that were still reactive in the retest were further confirmed by viral nucleic acid amplification test (PCR) and western blotting (WB). **Results:** A total of 9 of 20,222 unpaid blood donation samples were screened to be reactive, and the screening response rate was 0.04%; Two samples of HTLV-1 nucleic acid and western blotting (WB) were confirmed to be positive, and the other seven samples were negative; The confirmed positive rate was 0.01%. **Conclusion:** There was a certain positive rate of HTLV-1 serological screening among the non remunerated blood donors in Wuzhou City, and the confirmation test confirmed that there was a certain risk of HTLV infection; In order to further understand the HTLV infection of blood donors in this city, we should further increase the number of screening samples, so as to obtain more reliable and accurate data in this region, and provide data and reference for the health administration department to formulate HTLV screening strategies for blood donors.

1. INTRODUCTION

Human T lymphotropic virus (HTLV) is closely related to leukemia and can cause other diseases; Due to the harmfulness of diseases caused by HTLV and the characteristics of blood transmission, many countries and regions pay more and more attention to the detection and confirmation of HTLV, and gradually carry out systematic investigation and research on the infection situation of HTLV. Transfusion

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of blood products containing HTLV infected lymphocytes is the most common mode of transmission of HTLV through blood; Therefore, the most direct and effective method to prevent HTLV transmission through blood transfusion is HTLV screening for unpaid blood donors; At present, in some developed countries and regions with high prevalence of HTLV, HTLV screening has been included in the routine items of blood screening for blood donors [1, 2]. The research on HTLV in China is still in its infancy, and HTLV is not included in the routine screening of blood donors in the blood station technical operating procedures (2019 version). The purpose is to understand the HTLV infection of unpaid blood donors in Wuzhou City, and to provide data support for assessing the risk of HTLV transmission through blood transfusion. At the same time, it also provides the monitoring data of this outpost for the national health administration department, so as to provide a scientific basis for whether the country lists HTLV-I/II screening as a routine screening project for unpaid blood donation. According to the national monitoring requirements for HTLV infection in Guangxi, Wuzhou City, as one of the monitoring points, the laboratory of our station conducted HTLV-I/II serological screening on blood samples collected from unpaid blood donors in Wuzhou City from January 2018 to June 2018 and from December 2019 to August 2020. The test results are reported as follows.

2. MATERIALS AND METHODS

2.1. Specimen Source

There are 20222 blood samples from unpaid blood donors in Wuzhou central blood station from January 2018 to June 2018 and from December 2019 to August 2020.

2.2. Instruments and Reagents

2.2.1. Instrument

Xantus44/OH-150 automatic sampler (Shenzhen Aikang Electronics Co., Ltd.), TECAN (Tecan) automatic enzyme immunoassay workstation FREEDOM EVOLYZER-2 200 (Swiss TECAN SCHWEIZ company), FAME24/20, FAME24/30 full Automatic enzyme immunoassay system (Hamilton, Switzerland), the above instruments and equipment are verified and calibrated every year.

2.2.2. ELISA Kit

Human T-lymphocytic leukemia virus antibody ELISA detection kit (Beijing Wantai Bio-Pharmaceutical Co., Ltd.), batch numbers T20170904B, T20191109B; the reagents have the manufacturer's inspection report.

2.3. Methods

The domestic Wantai anti-HTLV-I/II ELISA detection reagent (double-antigen sandwich method) was used to detect 20, 222 human specimens. Operate in strict accordance with the instructions of the kit; The interpretation standard is that the samples with s/co value ≥ 1 detected for the first time need to use the same reagent for double hole retest; If the s/co value ≥ 1 in one hole of the retest is judged as HTLV screening reactivity; it shall be sent to the clinical testing center of the National Health Commission of China for virus nucleic acid and Western blot detection for confirmation.

2.4. Statistical Analysis

Use Excel statistical analysis to process data and draw corresponding charts.

3. RESULTS

Among the 20, 222 samples of unpaid blood donors, 9 samples with anti-HTLV-I/II reaction were screened, and the screening positive rate was 0.04% (9/20222); The virus nucleic acid (PCR) and Western

blotting (WB) of 9 samples with primary screening reactivity were further tested, and 2 were HTLV-1 positive and 7 were negative; The s/co value of the preliminary screening reactivity was between 1.12 - 2.50; After confirmation by viral nucleic acid and Western blotting, 2 were positive, including 1 male and 1 female, and 7 negative; The male-positive person has donated blood for the 8th time, and his native place is Cangwu County, Wuzhou City; the female-positive person has donated blood for the first time, and her native place is Cenxi, Wuzhou City. After investigation, the family members of the two positive blood donors have no history of leukemia, and they have been working and living in Wuzhou. The specific results are shown in [Table 1](#) below.

4. DISCUSSION

Human T-lymphotropic virus (HTLV) is the first RNA retrovirus found to be associated with cancer; A single positive-stranded RNA enveloped virus belonging to the Mammalian C type of the tumor virus subfamily of the Retroviridae family, which was first reported in 1980 [3]; American scholar Poiesz *et al.* [4] isolated the HTLV-1 virus from the skin T cells of a patient with cutaneous T-cell lymphoma. Since then, four HTLV subtypes have been isolated; Among them, HTLV-I promotes the occurrence of adult T-cell leukemia, related myelopathy, tropical spastic paraplegia and other diseases in infected patients by regulating the expression of HBZ, Tax protein and HMGB1 and co-regulates the transcription of virus and the proliferation of infected cells [5, 6]; Although some current treatment methods such as CHOP, CHOPE and super CAVD classic chemotherapy, Mogamulizumab monoclonal antibody, alemtuzumab, antigen CD52 and other targeted drugs, new antiviral drugs, immunomodulatory agents, interleukins and interferons have certain clinical therapeutic effects [7]; However, due to the complex mechanism of HTLV infection and individual differences, effective therapeutic drugs and preventive vaccines have not been successfully developed; Well, HTLV-II is related to the occurrence of T-hairy cell/megaloblastic leukemia and other disease; In addition, HTLV is also associated with some neurological diseases, uveitis, chronic inflammatory joint disease, and the occurrence of infectious dermatitis. The main routes of transmission are blood transfusion, sexual contact and mother-to-child transmission. The prevalence of HTLV infection is regional, mainly concentrated in southern Japan, sub-Saharan Africa, the Caribbean, central and western Africa, central and southern South America, Papua New Guinea, and northern Australia. In order to prevent the transmission of HTLV through blood transfusion, countries and regions such as Japan, the

Table 1. Information about anti-HTLV reactive blood donors in Wuzhou.

Serial number	Age	Gender	Nationality	Profession	Donate blood Frequency	Anti-HTLV (Wantai)		PCR Result	WB Result/ HTLV Type
						S/CO1	S/CO2		
1#	41	Female	Zhuang Nationality	other	1	1.17	1.3	—	—/—
2#	32	Female	the Han nationality	other	3	2.5	2.1	—	—/—
3#	45	Male	the Han nationality	other	8	1.2	1.4	+	+/HTLV-1
4#	35	Male	the Han nationality	other	4	1.6	1.75	—	—/—
5#	33	Female	the Han nationality	individual	1	1.89	1.92	+	+/HTLV-1
6#	40	Female	the Han nationality	staff member	2	1.23	1.19	—	—/—
7#	37	Female	Zhuang Nationality	individual	1	1.35	1.3	—	—/—
8#	42	Male	the Han nationality	teacher	3	1.15	1.12	—	—/—
9#	34	Female	the Han nationality	other	2	1.28	1.23	—	—/—

United States, France, the Netherlands, Sweden, South Korea, Taiwan of China and other countries and regions have successively included it in the routine blood screening program [8]. The infection rate of HTLV in my country is low, and HTLV has not been used as one of the routine screening items for blood donors. However, in recent years, my country has successively carried out HTLV screening studies in more than 20 provinces, cities and municipalities directly under the central government, including ELISA primary screening, WB or NAT confirmation. It was found that there is a certain proportion of HTLV infection in the population in many places, and HTLV-I type is mainly prevalent. The confirmed positive rate of special populations is higher in Henan, Hubei, Fuzhou, Ningde and other places, 0.39%, 0.2%, 0.58%, 0.33% respectively [9, 10]. The person with asymptomatic HTLV infection among voluntary blood donors has been reported in some areas, and the positive rate was slightly higher in the coastal areas of Ningde in Fujian, Xiamen, Putian, and Taizhou in Zhejiang, which were 0.34%, 0.13%, and 0.10%, 0.03%, respectively [11-14]; The positive rate was lower in inland Chengdu, Tianjin, Shijiazhuang, Lanzhou, Suzhou and coastal eastern Shenzhen, with 0.06%, 0.05%, 0.06%, 0.007%, 0.0039%, 0.0046% [15-20].

However, Chongqing, Zhengzhou, Luoyang, Shenyang, Beijing and other regions had a certain positive rate of HTLV serological screening, but no HTLV positive blood donors have been found after confirmation tests [21-24]. Among the 20222 blood donor samples screened in Wuzhou city, 9 samples showed reactivity, with a positive rate of 0.04%. Two samples were confirmed to be positive by PCR and western blotting, with a positive rate of 0.01%, which was similar to that in inland areas, indicating a low epidemic area. In addition, one of the confirmed positive patients had donated blood for the eighth time and had already donated blood successfully for seven times; The blood recipients were followed up by the clinical blood transfusion department, and no HTLV infection was found in the recipients who received the blood of the donor; Since HTLV-infected patients are mostly asymptomatic carriers, the incubation period after infection is 20 - 40 years [7]; and the follow-up time does not indicate that there is no infection, which suggests that when we carry out HTLV screening for first-time blood donors, the HTLV detection of repeated blood donors should not be ignored, otherwise such blood donors may further expand the risk of HTLV transmission.

Since 2015, the National Health Commission has allocated special funds for monitoring the prevalence of HTLV among blood donors in various regions of the country. Based on the HTLV screening and testing data of blood donors in various regions, the cost of blood donor testing and the harmfulness of HTLV will be assessed as the basis for whether HTLV needs to be included in the routine screening of national or local blood donors. The infection rate of HTLV in China is regional; the coastal areas of Ningde in Fujian, Xiamen, Putian, and Taizhou in Zhejiang have higher prevalence, so HTLV serological screening should be carried out for blood donors; the prevalence in inland areas is low, so whole blood can be treated with leucocyte filtration. At present, our station has not carried out routine HTLV test on blood donors. It can be seen from [Table 1](#) that one of the blood donors confirmed to be positive by PCR and WB has donated blood for the eighth time and belongs to a fixed unpaid blood donor. Therefore, there is a risk of HTLV transmission through blood transfusion in local clinical blood transfusion. In order to ensure the safety of clinical blood transfusion, we have plan to take the following measures: 1) earnestly do a good job in pre donation consultation, and try to exclude blood donors with high risk factors of HTLV infection; 2) Purchase blood bags with leukocyte filters to filter the collected whole blood; HTLV is infected with cd4+t lymphocytes; After filtering, the risk of HTLV transmission through blood transfusion can be reduced; 3) Before routine HTLV screening of blood donors, it is recommended that clinical blood transfusion $\leq 14d$ should not be conducted as far as possible, so as to inactivate the possible HTLV virus and reduce the residual risk of infection; 4) Purchase virus inactivation equipment to inactivate fresh frozen plasma; HTLV virus was inactivated by chemical methods such as methylene blue light and riboflavin light by using virus inactivation technology to reduce the risk of HTLV transmission through plasma.

5. CONCLUSION

There is a certain positive rate of HTLV-1 among the voluntary blood donors in Wuzhou, which be-

longs to the low-endemic area, but it still poses a certain risk of HTLV infection to clinical blood transfusion in Wuzhou.

6. LIMITATIONS OF THE STUDY

Since the object of this study is not a sample of the whole year, the data obtained are limited, and it is impossible to reliably and accurately understand the HTLV infection status of blood donors in this city.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the publication of this paper.

REFERENCES

1. Sun, X.T., Yang, Z.S. and Dai, Y. (2019) Current Status of Human T-Lymphotropic Virus Blood Donor Screening and Blood Transfusion Safety Strategy. *China Rural Medicine*, **26**, 78-80.
2. Liu, Z. and Li, L. (2017) HTLV and Blood Safety. *Chinese Journal of Blood Transfusion*, **30**, 221-223.
3. Song, B., Dai, Q.Y. and Wang, H. (2009) Research Progress of Human T-Lymphocyte Virus and Related Diseases. *Journal of Practical Medicine*, **26**, 73-75.
4. Poiesz, B., Poiesz, M. and Choi, D. (2003) The Human T-Cell Lymphoma/Leukemia Viruses. *Cancer Investigation*, **21**, 253-277. <https://doi.org/10.1081/CNV-120016422>
5. Chen, M.Y., Song, Z.W., Fang, J.Y., et al. (2017) Research Progress on Infection, Replication and Pathogenic Mechanism of Human T-Lymphocytic Leukemia Type 1 Virus. *Journal of Zhejiang Normal University (Natural Science Edition)*, **40**, 324 -330.
6. Li, Y., Xiong, W., Wang, S.B., Li, S.Q. and Yuan, Z.T. (2020) Expression Analysis of HTLV-1-Infected T Cell Clone Expansion and Transformation in Adult T Cell Leukemia. *Advances in Modern Biomedicine*, **20**, 121-124.
7. Chen, Y.Z., Wang, H.M., Duan, S.B., et al. (2019) Research Progress of Human T-Lymphotropic Virus. *China Journal of Blood Transfusion*, **32**, 605-610.
8. Deng, S.Z., Xie, J.W., Yan, K.F., et al. (2016) Preliminary Investigation on the Prevalence of HTLV among Blood Donors in Guangzhou. *Liaoning Medical Journal*, **30**, 14, 49.
9. Ma, Y., Zheng, S., Wang, N., et al. (2013) Epidemiological Analysis of HTLV-1 and HTLV-2 Infection among Different Population in Central China. *PLOS ONE*, **8**, e66795. <https://doi.org/10.1371/journal.pone.0066795>
10. Wang, H.R., Yan, Y.S., Zhang, Q.W., et al. (2004) Seroepidemiological Study on Human T-Lymphocytic Leukemia Virus I/II Infection in Eastern Coastal Areas of Fujian. *Chinese Journal of Epidemiology*, **25**, 428-430.
11. Xu, D.F., Li, H.H. and Tang, C.L. (2015) Investigation on HTLV-I/II Infection among Voluntary Blood Donors in Ningde City. *Chinese Journal of Blood Transfusion*, **28**, 63-64.
12. Li, L., He, L. and Xie, J.Z. (2018) Study on HTLV Screening Model of Unpaid Blood Donors. *Chinese Journal of Blood Transfusion*, **31**, 998-1000.
13. Lin, T.H. and Xu, H. (2014) Investigation and Analysis of HTLV-I/II Infection among Voluntary Blood Donors in Putian Area. *Chinese Journal of Blood Transfusion*, **27**, 754-756.
14. Zheng, Z.H., Feng, Y.Q., Wang, X.F., et al. (2015) Investigation on Human T-Lymphocytic Leukemia Virus In-

fection among Unpaid Blood Donors in Taizhou Area. *Chinese Journal of Blood Transfusion*, **28**, 426-427.

15. Liu, H.M., Chen, X., Li, W.J., Luo, Y.L. and Mei, J. (2020) Analysis of HTLV Screening among Voluntary Blood Donors in Chengdu. *China Journal of Blood Transfusion*, **33**, 80-81.
16. Li, S.Y., Zhao, Y. and Xie, J.H. (2019) Investigation on HTLV Infection among Voluntary Blood Donors in Tianjin Area. *Continuing Medical Education*, **33**, 94-96.
17. Li, L.H., Qi, H. and Chen, L. (2018) Analysis of HTLV-I/II Detection in Voluntary Blood Donors in Shijiazhuang Area. *Clinical Blood Transfusion and Testing*, **20**, 482-484.
18. Wu, K.L., Teng, Y., Qin, Y.L., *et al.* (2019) Analysis of HTLV Infection among Voluntary Blood Donors in Lanzhou. *China Journal of Blood Transfusion*, **32**, 58-60.
19. Jiang, N.N., Dong, L., Zheng, X.Q., *et al.* (2017) Investigation of HTLV Infection Status among Voluntary Blood Donors in Suzhou City. *International Journal of Laboratory Medicine*, **38**, 139-140.
20. Shan, Z.G., Liao, Q. and Jiao, X.Y. (2020) Investigation of HTLV Infection among 43,305 Unpaid Blood Donors in Eastern Shenzhen. *Chinese Journal of Blood Transfusion*, **33**, 616-619.
21. Hu, J., Li, B. and Zhao, S.M. (2003) Investigation on HTLV-I Infection among Blood Donors in Chongqing Area. *Chongqing Medicine*, **32**, 763-764.
22. Lu, Y.L. and Jiao, X.F. (2015) Investigation on HTLV Infection among 8800 Unpaid Blood Donors in Zhengzhou Area. *Henan Medical Research*, No. 9, 41-43.
23. Liu, W., Wang, F., Wang, X.M., *et al.* (2014) Investigation on HTLV-I/II Infection among 9050 Unpaid Blood Donors in Shenyang Area. *Chinese Journal of Health Inspection*, **24**, 588-590.
24. Guo, J.J., Zhang, W., Zhang, W.X., *et al.* (2015) Investigation on HTLV Infection among Blood Donors in Beijing Area. *Clinical Blood Transfusion and Testing*, **17**, 82-83.