



Mutual blood donation is safer at small blood collection stations in China



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ABSTRACT

Background: The assumption that the level of safety of voluntary non-remunerated donors is significantly higher than that of family replacement donors is supported by global data without stratifying for first-time or repeat volunteer, or according to age, but the viral marker prevalence between replacement donors and first-time voluntary non-remunerated donors is similar.

Materials and methods: From 2006 to 2013, replacement and voluntary donors were respectively recruited by the hospitals and the Center Blood Station in Zhaoqing, Guangdong, according to the existing procedures, and all the donors were screened for hepatitis B virus (HBV) surface antigen (HBsAg), antibodies against hepatitis C virus (anti-HCV), human immunodeficiency virus (anti-HIV) (1 + 2) and *Treponema pallidum* (anti-TP) by the enzyme immunoassays (EIAs), and alanine aminotransferase (ALT) in the Center Blood Station by kinetic analysis method. The risk factors related to blood safety were analyzed by Binary logistic regression analysis.

Results: Between 252,202 volunteers and 2771 replacement donors, the prevalences of ALT > 40 U/L and anti-HIV (4.88% and 0.01% vs 4.44% and 0.07%, respectively) were not significantly different. The prevalences of HBsAg, anti-HCV and anti-syphilis in replacement group were higher than those in voluntary group, which were related to donor's sex, age and donation time. Overall prevalence of serological markers was higher in male replacement donors than in female, and in replacement donor over 30 years than in those below 30 years, but the positive prevalence in repeated replacement donors was lower than that in first-time replacement donors.

Conclusions: With appropriate intervention measures, such as pre-donor screening and other donor selection policy, replacement donors and voluntary donors provide a similar level of viral safety. Our donor selection policy in future should focus on retaining both young replacement and young voluntary donors as repeat donors and promoting the donation proportion of females, which will improve blood safety.

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1. Introduction

Blood transfusion is a replacement therapy, which calls for products of human origin taken from healthy blood donors and given to patients called recipients. Because of its human origin, many diseases, such as HBV, HCV, HIV, syphilis, West Nile virus, prion virus and other unknown virus may be transmitted from donor to the recipient by blood or blood component infusions [1]. A critical step in blood safeguarding is to collect blood from low-risk population. Blood donors were classified 3 types: voluntary non-remunerated, mutual (family/replacement) and paid donors. For many years, WHO and many western transfusion experts have recommend exclusively that, in order to minimize the risks, voluntary and non-remunerated blood donation is the corner stone of a safe and adequate national blood supply which meets the transfusion requirements of all patients, and eliminated replacement donors who promoted to provide blood to one of their relatives or friends [2].

However, some transfusion experts have pointed out that these assumptions of WHO have not been supported by evidence, and recent published evidence clearly indicates that the lower level of safety of family or replacement donor compared to first-time volunteers in several countries of Sub-Saharan Africa is not substantiated [3,4]. After comparing the relative of first-time volunteers and replacement donors in West Africa, Allain et al. thought that the donor selection policy focusing on strategies to retain both volunteers and replacement donors as repeat donors would improve the safety of the donor pool and improve the blood supply significantly [5,6].

In the past, replacement donors were often mixed with paid donors who were widely recognized to be “unsafe”. But today in China, hospitals and blood transfusion services had made great effort to eliminate paid donors leaving genuine replacement donors, so the evidence and policies around the safety characteristic of replacement donors need to be reexamined.

The objective of the study was to compare the epidemiology of viral marker and ALT in volunteers and replacement donors with special intervention measures, including appropriate donor selection policy and pre-donor screen. At the same time, the factors such as repeat donation time, age, sex, occupation, education level of donors, which may be the relative risk of blood safety, were analyzed by Binary logistic regression analysis.

2. Materials and methods

From 2006 to 2013, replacement and voluntary donors were identified from electronic records at Zhao Qing blood center in Guangdong province, China. Donation time, age, sex, occupation, education and screening results were recorded. All pre-donors were selected according to the Standard for health examination of blood donors (GB18467–2011, China), and replacements were required to fill the application form for replacement donation and to confirm the relatives with recipient. After health examination and satisfying the weight (male >50 kg, female >45 kg) and blood pressure (60 mmHg ≤ diastolic blood pressure < 140 mmHg,

90 mmHg ≤ systolic blood pressure < 140 mmHg, pulse blood pressure ≥ 30 mmHg) pulse pressure requirements, for each type of donors, rapid tests for hepatitis B surface antigen (HBsAg, Colloidal gold labeling method) and amino acid transference (ALT, dry chemical method) were performed before donation. Nonreactive donors were suitable for donation. When the whole blood units were collected, homolog blood sample were collected simultaneously and serum were tested HBsAg, anti-HCV, anti-HIV(1 + 2) and syphilis by enzyme linked immunosorbent assay (ELISA), and were tested ALT by kinetic analysis method. All the viral markers were detected twice by two different reagents, and reactive samples were confirmed by repeat test. Reactive anti-HIV samples were confirmed at local public-health-station HIV reference laboratories certified by the Ministry of Health. ALT were also detected by two different reagents, either result exceeding 40 U/L (after 2012, male >45 U/L, female >40 U/L) was considered abnormal.

Differences in seroprevalence (including viral markers and ALT) between groups were tested for significance by chi-square test (p value <0.05 was significant). Relative risks of blood safety were tested by Binary logistic regression analysis (SPSS software, version 18.0).

3. Results

From 2006 to 2013, the numbers of 2771 qualified replacement donors and 252,202 qualified voluntary donors were recruited and detected, according to the procedures in Fig. 1. A total of 2771 replacement donors were classified into three types: first degree relatives accounting for 55.9%, unrelated relatives accounting for 26.3%, other relatives accounting for 22.8% (showing as Fig. 2).

Results of 5 serological marker distributions between two groups were presented in Table 1. The total seroprevalence was higher in replacement group than in voluntary group ($p < 0.05$), but differences of individual markers were not identical. The prevalence of HBsAg, anti-HCV and syphilis in replacement group were higher than in voluntary group ($p < 0.05$), and the prevalence of ALT and anti-HIV were not significantly difference ($p > 0.05$).

The general information of donors such as age, gender, donation time, occupation and the level of education were searched for risk factors, and Statistical analysis showed that sex, age and donation time were three independent risk factors related to blood safety (Table 2). Total positive prevalence was higher in male replacement donors than in female, and was higher in replacement donors over 30 years than in those below 30 years. But the positive prevalence in repeated replacement donors was lower than that in first-time replacement donors (data shown in Table 3).

Male donors accounted for the majority proportion of the donors, and the proportion of male replacement donors was as high as 81% (Fig. 3). The proportion of young donors in volunteers was higher than in replacement donors (42% vs 37%, Fig. 4). The proportion of first time replacement donor was higher than those in volunteers (78% vs 38%, Fig. 5).

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