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The relationship of platelet yield, donor's characteristic and apheresis instruments in China

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ABSTRACT

Platelet yield was associated with donor's characteristic and property of apheresis instruments. Here, we have analyzed the relationship of platelet yield, physiologic parameters of donors for different apheresis instruments in China. Data were consecutively retrieved from plateletapheresis donors during March 1, 2007 and March 1, 2012. Three different apheresis instruments MCS+, Amicus, Trima system were used for plateletapheresis and defined as group 1, 2 and 3 respectively. Totally 77,091 Plateletapheresis donations were performed in this study. 17 donations were finally aborted because of vasovagal reaction with syncope. 5861, 37,036, 34,177 donations were performed in group 1, 2 and 3 respectively. Hct and platelet values before donations were similar, but platelet yield and collection rate were showed significantly difference ($p < 0.05$) among the three groups. The values of platelet and Hct in the males before donations were higher than those in the females, and the platelet yield and collection rate were showed significantly difference between the male group and female group ($p < 0.05$). The overall reaction rate was 1.56%. Most donors were chosen the group 2 (51.6%) for next donation, followed by group 3 (33%) and group 1 (15.4%). We concluded that the platelet yield and collection rate in the male group were higher than those in the female group and the efficiency of plateletapheresis was associated with the kind of apheresis instruments and donor's characteristic. These data will help to work out suitable apheresis protocol based on the Chinese donor's characteristic.

1. Introduction

Platelet transfusions play an important role in prevention or treatment of bleeding in patients with thrombocytopenia or severely impaired platelet function. Platelet concentrates (PCs) were prepared from either whole-blood donations or by plateletpheresis, most of them were from plateletpheresis in China. In recent years, the demand for PCs was increasing annually and now supply of PCs cannot satisfy all patients' requirements in China. In order to provide more PCs products, it is important to recruit more donors and improve the efficiency of plateletpheresis.

Many studies had previously reported that the relationship for platelet (PLT) yield, collection rate (CR), and adverse reactions of different apheresis systems by prospective paired comparison over the past years [1–9]. These may be help to work out the best apheresis protocol for different donors and various apheresis equipments. However, the blood donation guideline in China and standard of the plateletapheresis donation were different from the other countries. Therefore, the effects of some parameters including PLT yield, weight, body mass index (BMI) and hematocrit (Hct) on plateletapheresis in China may different from the others, but there was rare reported. In

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this study, we performed a retrospective analysis to determine the relationships of these variables from plateletapheresis donations in blood center of Zhejiang Province in China.

2. Materials and methods

2.1. Apheresis donor screening

According to blood donation guideline (GB18467-2001) in China, all donors need to fill a risk factor questionnaire to exclude those with exposures which would increase their risk of having a transfusion transmissible infection, and perform the physical examination by the doctor before acceptance for donation. Donor's height and weight were determined using height and weight scale. Hemoglobin (Hb), Hct and platelet were determined with the hemocytometer instrument (Automated Hematology Analyzer Xs-800i, Sysmex corporation, Kobe, Japan). The donor with $Hb \geqslant 120$ g/l for male and $110 \geqslant$ g/l for female, platelet count $\geqslant 150 \times 10^9$/L and $Hct \geqslant 0.36$ was permitted to plateletapheresis. After screening, qualified donors were given oral calcium gluconate prior to donation and preformed the plateletapheresis for one time.

2.2. Plateletapheresis with apheresis equipments

11 sets of MCS Plus (Haemonetics Corporation, Braintree, MA), 10 sets of Amicus (Version 2.5, Fenwal Division, Deerfield, IL) and 6 sets of Trima Accel (Version 5.0, Gambro BCT, Lakewood, USA) apheresis equipments were used for plateletapheresis, and defined as group 1, 2 and 3 respectively. All equipments were single needle systems and randomly selected by the staff. The plateletapheresis procedures were preformed according to the manufacturer's instructions. The group 2 was used saline and acid citrate dextrose-A (ACD-A) solution for set priming at the beginning of the procedure, whereas the group 1 and 3 were used ACD-A solution. The program settings of the apheresis equipments were equivalent to those used in other studies [10–12]. Based on the donors' characteristics, the endpoint of plateletpheresis was set by the cell separator according to the programmed target yield (2.5×10^{11} for single-unit PCs, 5.0×10^{11} for double-unit PCs) in up to 60 and 90 min. Reaction rates of immediate adverse effects among donors undergoing apheresis procedures were recorded according to the McLeod criteria [13]. Platelet yield of products was determined with hemocytometer (Automated Hematology Analyzer Xs-800i, Sysmex corporation, Kobe, Japan) after donation.

2.3. Data collection and analysis

All data were from the records of all plateletapheresis donations during March 1, 2007 and March 1, 2012 in blood center of Zhejiang Province, China. The demographic data of plateletapheresis donor and the relationship of platelet yield, physiologic parameters (gender, age, height, weight, BMI, PLT and Hct) of the donors were evaluated. The following formulas were used as platelet yield = platelets in the product (per mL) × harvest volume (mL), BMI = weight (kg)/height (m²), collection rate (CR) = platelet yield $\times 10^{11}$/processing time.

2.4. Questionnaire after donation

In order to find out which equipment was prefer to choose by donors, the 3587 repeat voluntary donors were asked to complete a questionnaire after donation randomly. The first question was "which equipment would you prefer for your next donation? MCS Plus, Amicus or Trima Accel". Every donor would choose only one. The second question was "Why do you select the equipment? The reasons are impact of the needle, comfort, less adverse reactions, quick donation or silence, personal, and others". Every donor can choose more reasons.

2.5. Statistical analysis

Statistical analysis was performed with SPSS Version 12.0 software (SPSS Inc., Chicago, IL). The results were tested for normal distribution by means of the Shapiro–Wilks test. In the case of normally distributed data, t test was used for paired or unpaired samples. If the measures were not distributed normally, statistical analysis was performed with the U test. Linear association between two variables was ascertained with the Pearson's r test. For all analyses, statistical significance was defined as $p < 0.05$.

3. Results

3.1. The characteristics of donations

77,091 plateletapheresis donations were preformed during March 1, 2007 and March 1, 2012. 17 donations were finally aborted because of vasovagal reaction with syncope. Of the 77,074 donations, group 1, 2 and 3 were 5861, 37,036, 34,177 donations respectively. There were 57,574 (74.7%) males and 19,500 (25.3%) females. The median age of the men was 37.6 years and women was 39.2 years. The characteristics of donations were shown in Table 1.

3.2. Platelet yield and CR in different groups

The values of platelet and Hct in the males before donations were higher than those of the females (Table 2), and the platelet yield and CR were showed significantly difference ($p < 0.05$) between the male group and female group.

Table 1
The characteristics of donations (n = 77,074).

Characteristic	Mean (SD)	Median (range)
Age (years)	36.4(9.5)	39(18–55)
Male (n = 57,574)	36.2(9.6)	37.6(18–55)
Female (n = 19,500)	37(9.3)	39.2(18–54)
Weight (kg)	61.2(9.2)	59(50–88)
Height (m)	1.67(0.11)	1.68(1.48–1.86)
BMI	22.0(2.0)	21.4(17.2–31.0)
Hct (%)	43.1(3.4)	43(34–51.1)