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Original article

Changes in pre- and post-donation platelet function in plateletpheresis donors

Modifications de la fonction plaquettaire pré et postdonation chez les donneurs de plaquettes

Q. Zhou *, X. Yu , Y. Cai , L. Liu

Blood Donation Serving Section II, Beijing Red Cross Blood Center, No. 37, North Sanhuanzhong Road, 100088 Beijing, Haidian District, China

Abstract

Objectives. – This study aimed to investigate the changes of platelet (PLT) function and coagulation time before and after plateletpheresis donation.
Material and methods. – The healthy donors were divided into four groups according to the annual number of plateletpheresis donation: 20 times group, 15 times group, 10 times group and 5 times group. The healthy non-blood donors were selected as controls. The donation interval was 14 days. The blood samples were collected before plateletpheresis donation and after 30 min, 7 d, and 14 d of donation for determination of coagulation time, PLT function, plasma protein, serum iron and blood routine change.
Results. – After 30 min of plateletpheresis donation, the PLT function decreased and the coagulation time was prolonged. However, PLT function recovered to the pre-collection after 7 d of plateletpheresis donation and coagulation time recovered to the pre-collection after 14 d of plateletpheresis donation. Additionally, there was no difference regarding blood coagulation time and PLT function among blood donors and controls. The plasma protein and serum iron levels in 20 times and 15 times groups were within the normal reference range.
Conclusion. – The frequency of plateletpheresis donation will not affect PLT function, coagulation time, plasma protein and serum iron in donors.

Keywords: Platelet; Plateletpheresis; Coagulation time; Plasma protein

Résumé

Objectifs. – Cette étude visait à étudier les changements de la fonction plaquettaire (PLT) et le temps de coagulation avant et après le don de plaquettes par aphérèse.
Matériel et méthodes. – Les donneurs en bonne santé ont été divisés en quatre groupes selon le nombre de dons de plaquettes par aphérèse annuellement: groupe de 20 fois, de 15 fois, de 10 fois et de 5 fois. Les non-donneurs sains ont été sélectionnés comme groupes de référence. L'intervalle entre les dons était de 14 jours. Les échantillons de sang ont été prélevés avant la donation de plaquettes par aphérèse et après 30 minutes, 7 jours et 14 jours pour la détermination du temps de coagulation, de la fonction PLT, des protéines plasmatiques, du fer et du sang.
Résultats. – Après 30 minutes de donation en plaquettes, la fonction PLT a diminué et le temps de coagulation a été prolongé. Cependant, la fonction PLT a été rétablie à la précollection après 7 jours de donation en plaquettes ainsi que le temps de coagulation à la précollection après 14 jours. En outre, il n'y avait aucune différence significative entre les groupes de donneurs et ceux de référence en fonction du temps de coagulation et de la fonction PLT. De plus, dans les groupes de 20 fois et de 15 fois, les concentrations plasmatiques de protéines et de sérum étaient dans la gamme de valeur de référence normale.
Conclusion. – Chez les donneurs, la fréquence de donation de plaquettes par aphérèse n'affecte pas la fonction PLT, le temps de coagulation, les protéines plasmatiques et le fer sérique.

Mots clés : Plaquette ; Aphérèse ; Temps de coagulation ; Protéine plasmatique

* Corresponding author.
E-mail addresses: qianzhouqzqz123@163.com (Q. Zhou), zijin20010506@163.com (X. Yu), caicaibc@163.com (Y. Cai), 1434708851@qq.com (L. Liu).

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1. Background

Shortage of platelets (PLTs) is a common issue for many hospital-based blood banks. Consequently, managing the platelet inventory is an important endeavor [1]. Plateletpheresis is a method of collecting the PLTs by a device used in blood donation, which can separate the PLTs and return other portions of the blood to the donor [2]. The development of plateletpheresis makes it possible to obtain a large number of PLTs from a single donor to provide nearly all thrombocytopenic patients with sufficient quantities of single-donor platelet concentrates [3]. Plateletpheresis could reduce the risk of immediate transfusion reactions and disease transmission by blood transfusion [4]. Additionally, plateletpheresis simplifies human leukocyte antigen matching and improves the chance of a successful transfusion. Plateletpheresis has become a routine procedure in most of the blood centers in developing countries [5].

Plateletpheresis should be performed under the guidance and supervision of a physician. The procedure is considered relatively safe and is generally well tolerated [4]. In most countries, strict inclusion criteria have been established for the selection of blood donors in order to protect both the donor and recipient [6]. In the recent issued "While blood and component donor selection requirements (GB18467-2011)" in China, the donation interval was changed from 28 days to 14 days. Shortening the donation interval directly doubles the number of blood donation, which would lead to some problems. For instance, whether frequent blood donation would affect the regeneration function of PLT donors or not. In addition, the increased donation times increase the plasma collection, which may have an influence on the coagulation function and protein content. Moreover, there usually remains 50–100 mL blood in the instrument after blood donation. Whether the increased donation times would increase the accumulation of blood loss and then lead to anemia. However, to our best knowledge, there is lack of scientific experiment to investigate these problems above.

Therefore, the present study was proposed to investigate the changes of PLT function and coagulation time before and after plateletpheresis. Additionally, the effects of collection frequency on plasma protein, serum iron and blood cell counts were also investigated. Findings of this study would help to ensure the safety of blood donor team, as well as to provide reference for the development of safety standards of blood donations by healthy administrative department.

2. Materials and methods

2.1. Study subjects

A total of 51 healthy donors with an average age of 33.13 ± 8.79 years, height of 170.67 ± 9.25 cm and weight of 70.83 ± 10.14 kg were selected from plateletpheresis donor registration during July 1st, 2012 to June 30th, 2013 in Tangshan Morden Database System. They were divided into four groups: 20 times group: annual number of plateletpheresis donations ≥ 20 times ($n = 29$); 15 times group: annual number of plateletpheresis donations ≥ 15 but < 20 times ($n = 12$); 10 times group: annual number of plateletpheresis donations ≥ 10 but < 15 times ($n = 5$); 5 times group: annual number of plateletpheresis donations ≥ 5 but < 10 times ($n = 5$). Additionally, 15 healthy persons (average age: 35.75 ± 4.79; average height: 172.45 ± 7.55 cm; average weight: 68.35 ± 8.20 kg) were enrolled as controls. They were selected from the plateletpheresis donors for the first time and their PLT samples were collected before plateletpheresis donation. All participants have given their written informed consents before study.

2.2. Inclusion and exclusion criteria

All the participants in this study were male, weighting ≥ 55 kg, with ages ranging from 18 to 50 years. They voluntarily agreed to participate in this study and successfully donated 2U PLT (PLT counts $\geq 220 \times 10^9$/L).

The donors with the following criteria were excluded:

- blood examination indicators, including blood type, hemoglobin, alamine aminotransferase (ALT), hepatitis b virus infection markers, treponema pallidum infection markers, PLT, and hematocrit were substandard;
- any of the following situations appeared during the process of blood collection: red blood cell spill-over (red blood cell spill into the collected product plasma), aggregation, chylemia, low peak value of PLT, involving modification of instrument parameters;
- the one who had donation reaction.

2.3. Study design

For each PLT donor, four sodium citrate anticoagulation blood samples (1 mL for each sample) were collected from the other arm fossa cubitalis of donors at the last time of PLT donation. The collection time of the four samples were: before plateletpheresis donation, 30 min, 7 d, and 14 d after donation. The plateletpheresis donation interval for each donor was 14 d. Moreover, before each donation, PLT, red blood cell, hemoglobin count and hematocrit were recorded for all donors.

2.4. Detection method

Blood routine was examined by Beckman Coulter hematology analyzer (Beckman Coulter, USA). Blood coagulation time and PLT function were determined by thromboelastography (Haemonetics Corporation, USA). Plasma protein and serum-iron were detected by Beijing DORUN International Technology Co., Ltd (Beijing, china).

2.5. Statistics analysis

The result was analyzed using SPSS version 16.0. Data were expressed as mean ± standard deviation (SD). Comparisons among different groups were analyzed using one-way analysis of variance. $P < 0.05$ was set as significant difference.

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