THROMBOCYTOPHERESIS FROM A SINGLE DONOR USING AUTOMATED APHERESIS SYSTEM: Advantages and Problems

(Received April 8, 1991)

B. Zülfikar, M.D.* / S. Anak, M.D.** / K. Durak, **** / G. Gedikoğlu, M.D.***

* *Professor, Department of Pediatric Hematology-Oncology, Faculty of Medicine, İstanbul University, İstanbul, Turkey.*
** *Assistant Professor, Department of Pediatric Hematology-Oncology, Faculty of Medicine, İstanbul University, İstanbul, Turkey.*
*** *Specialist, Department of Pediatric Hematology-Oncology, Faculty of Medicine, İstanbul University, İstanbul, Turkey.*
**** *Student, Faculty of Medicine, İstanbul University, İstanbul, Turkey.*

SUMMARY

Since October 1989 at İstanbul University, İstanbul School of Medicine, Our Children-Leukemia Foundation and Department of Pediatric Hematology/Oncology we have focused on the systematic use of apheresis techniques especially for thrombocytopheresis. Fifty-six thrombocytopheresis were performed. Complete blood count, blood groups were determined and compatible donors with a platelet count ≥ 200 000/μL and negative serologic tests (Hepatitis B, CMV, HIV, malaria, syphilis) were selected. In 6/56 thrombocytopheresis (10.7%) the aimed number of cycles could not be achieved. Fifty applications were completed. Six units of platelets each from 29 donors (51.7%) and less than 6 units each from the other donors were collected. The platelet counts in the collected platelet concentrates were between 299-1024x10^9/L. Each unit contained about 30-60 ml of platelet suspension. Each unit only contained very little amounts of RBC and WBC contamination. Apheresis techniques based on autosurge automated protocols are very useful and needed in every center applying intensified chemotherapy protocols which need vigorous supportive measures.

Key Words: Thrombocytopheresis, transfusion, platelet.

INTRODUCTION

While modern anticancer therapy is becoming more aggressive, including bone marrow transplantation programs and high dose chemotherapy regimens, more vigorous measures are needed to support patients through periods of prolonged pancytopenia. Platelet transfusions are crucial in supportive care (1-3), and have been used in clinical medicine for approximately 70 years (4), but in the preparation and preservation of platelets, application methods of anticoagulants, important progress was gained including advanced apheresis systems. Randomly pooled platelets may lead to permanent platelet refractoriness due to HLA alloimmunization. Therefore, using single donor HLA matched platelets is obligatory in some cases (1, 5-7).

In addition, cellular contamination in the blood products may cause nonhemolytic febrile reactions, rejection of transplants, infection transmission and reduction of immune response (5, 8-10). Since October 1989 we have focused on the systematic use of apheresis techniques especially for the transfusion of platelets,at İstanbul Medical School, Our Children-Leukemia Foundation and Department of Pediatric Hematology/Oncology.

MATERIALS and METHODS

Apheresis Systems and Application

For the thrombocytopheresis, component collection, thrombocytopheresis autosurge (RBC free, WBC poor) operating protocols of Haemonetics V50 (automated) apheresis system with continuous flow technique was applied in our center (Fig.). This system is also suitable for lymphocyte, granulocyte, RBC, plasma, platelet-rich plasma, stem cells pheresis, collection of mononuclear cells from bone marrow and plasma exchange. After cleaning the antecubital area with an antiseptic, blood was collected through a 19G needle using continuous flow technique; after collection of platelets, the rest of the blood was given to the donor in each cycle (approximately 15 minutes); 6-8 cycles were aimed. Complete blood count of each unit was done before irradiation (15-30 Gy) and use of the product.

Donor Selection

Between October 1989 - August 1990, 56 thrombocytopheresis (49 male / 7 female donors of age 22-58 years) were performed. Before each procedure, all donors were weighed, their CBC was measured

(RBC, WBC, platelet count) using Coulter Counter S plus J and blood groups were determined. Compatible donors with a platelet count ≥ 200 000 / uL and negative serologic tests (Hepatitis B, CMV, HIV, malaria, syphilis) were used for thrombocytopheresis. The number of the cycles were determined according to the patients' needs or donor's capacity. After the cessation of the procedure, CBC was measured again.

RESULTS

Application Problems and Side Effects

In our center 56 thrombocytopheresis were performed using 48 donors in ten months. In 6/56 thrombocytopheresis (10.7%), aimed number of cycles, could not be achieved. The problems during the applications were; power cut (1 case), voltage insufficiency (2 cases), impairment of the component collection sets (3 cases- 5.3%), inappropriate donors (weight <60 kg, 2 cases), problems due to inappropriate vessels (6 cases), faults in the application of collection sets (5 cases).

Only 1 unit of platelet was collected from the 2 low-weight donors and from 1 donor with inappropriate vessels. 3 units of platelets were collected from each of the other 5 cases with inappropriate vessels. Due to the faults in the application collection sets 3 units of platelets were collected in 1 case and 5 units of platelets were collected in the other 4 cases.

The contamination RBC and WBC counts in the platelet concentrates of the 50 procedures is 54.8±35 (10-290) x 10^9/L for RBC, and 0.66±0.15 (0.12-2.2)x10^9/L for WBC.

During the applications, the problems of the donors were pain at the venosection site (n=18), impairment of taste (n=27), dizziness (n=4), syncope (n=2). Syncope and severe local pain were the only cycle number limiting causes.

Hematological Parameters

From the 50 applications which were completed, 6 units of platelets were collected from 29 donors (51.7%), 5 units were collected from 11 donors (19.6%), 3 units of platelets were collected from 7 donors (12.5%), and only 1 unit of platelet was collected from the 3 donors (5.3%). The changes in the platelet count of the donors during the apheresis are summarized in **Table I.** The platelet counts in the collected platelet concentrates were between 299-1024 x 10^9/L. Each unit contained about 30-60 ml of platelet suspension. The platelet counts in the platelet concentrates were 522±200 (299-1024)x10^9/L. (Table II).

DISCUSSION

Patients with thrombocytopenia due to diminished platelet production are the most frequent user of platelet concentrates. These include patients with leukemia, aplastic anemia, certain congenital thrombocytopenias, and extensive bone marrow replacement, as well as patients on cancer chemotherapy or those who have received other bone marrow toxins (4).

Although great progress is achieved in blood banking, providing enough number of platelet concentrates still remains a problem in our country, Turkey due to the lack of sophisticated technology. Centrifugation and continuous flow techniques are the most widespread methods used in providing platelets. More developed but expensive and time consuming continuous flow technology has been proved to be cost beneficial due to less cellular contamination, less infectious transmission, better quality and guantity in platelet provision, compared with centrifuge technique. Pinqaut et al (11), Reiff et al (12) suggested the practicability and the efficacy of this system in their studies. Single donor systems like continuous flow technique, are being used in increasing numbers all through the world. For example in the USA from 1980 to 1987 transfusion of total platelet concentrates/concentrates optained from single donors, are as follows;
in 1980 3 195 000 units / 56 000 packs,
in 1984 4 179 000 units / 168 000 packs,
in 1987 6 384 000 units / 262 000 packs. Total transfusion of platelets increased twice in 7 years but the transfusion from single donors with apheresis increased 5 times at the same time (13). In the blood bank of Hacettepe University only 6300 units of platelet concentrates are provided in 1989 (14).

As can be seen from Table I, th decrease in the donor platelet count is more prominent as the number of collected units from a single donor increases. This may be attributed to the collection of platelets as the cycles increase. However, this decrease is insignificant to risk the life of the donor because the blood volume can easily compensate for this loss. On the other hand the platelet counts increase in the collection bag as the number of units taken from a single donor increase (Table II). The automated apheresis system is designed to provide more concentrated platelets from less amounts of plasma as the number of cycles increases.

Alloimmunization and refractoriness to platelets are

frequent in vigourously transfused oncologic patients provoked by leukocytes present in routinely prepared (centrifuge technique) platelet concentrates. Effective prophylaxis against platelet refractoriness in multitransfused patients can be achieved by the use of leukocyte -free blood components provided by filtering systems-UV-radiation, single donors apheresis system (continuous flow technique) (1, 2, 8, 10, 15). In our study, high contamination rate might be attributed to the lack of enough experience in the use of the apparatus in the first few applications. We used special filters (PALL-PLSO) to compensate this problem.

The use of platelet concentrates from one donor, as opposed to multiple donors, may provide an effective means of reducing the incidence of febrile reactions. Chambers et al. (5) noticed that the febrile reaction rate is 14.2% with 1204 multiple donor (pooled concentrates) platelets transfusion and 8.4% with 438 single donor platelets transfusion.

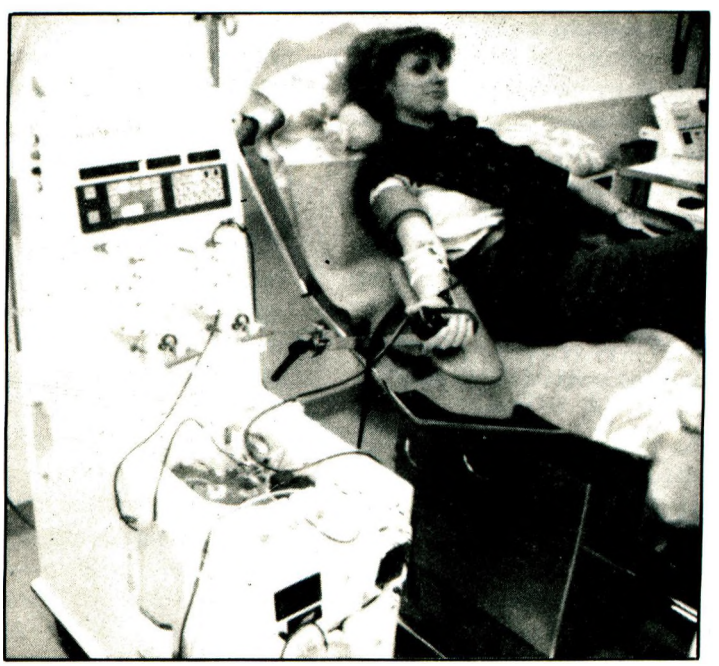
In conclusion, in developing countries, providing blood and blood products like platelets is still a time consuming and expensive procedure and using single donor automated apheresis systems (continuous flow technique) can decrease the threat of platelet refractoriness and can allow better supportive care and more aggressive approaches in anticancer therapy and bone marrow transplantation.

Table I. The changes in the donor platelet counts

Collected units	No of donors	Decrease in the donor platelet counts mean (range) $x10^9/L$
1	3	44 (3-103)
3	7	50 (23-83)
5	11	65 (32-85)
6	29	69 (13-120)

Table II. The platelet counts of concentrates

No of units taken from a single donor	Platelet counts mean (range) $x10^9/L$
1	352 (299-353)
3	471 (326-558)
6	744 (543-1024)



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