

Original Article

Preliminary study of variation in pre and post hematological values of healthy plateletpheresis donors.

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Abstract

Background: At this instant, automated cell separators are used for the purification of platelets from healthy donors but the donor's safety should not be overlooked. Hence, the present study aimed to compare the effect of platelet apheresis (via mega unit) on hematological indices of healthy donors.

Methodology: In this cross-sectional study, 100 samples of healthy plateletpheresis or thrombopheresis donors were included. The pre and post plateletpheresis hematological parameters were assessed. The total platelet count (PLT), hemoglobin (Hb), white blood cells count (WBCs), red blood cells count (RBCs), mean cell volume (MCV), mean cell hemoglobin (MCH) or mean corpuscular hemoglobin concentration (MHCH) were estimated through complete blood count (CBC) analysis and platelet apheresis was done by Mega unit Haemonetics MCS+9000 Cell Separator and 994- CFE.

Results: After platelet apheresis procedure, a significant decrement in PLT value (p-value <0.001). And with that a remarkable difference was also observed in the haemoglobin, MCH and MCHC.

Conclusion: In conclusion, the hematological parameters significant decree among donors after the procedure of platelet apheresis but the revealed characteristics of thrombocytopenia and anemia were not found.

Keywords

Plateletpheresis, Platelet Count, Thrombocytopenia, Blood Donor.



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Introduction

Platelets grow constantly from megakaryocytes, especially in the bone marrow, involved not only in hemostasis and arterial thrombosis, but also in other physiological and pathological processes¹. Thrombocytopenia can also be caused by the use of platelets during the ongoing process of coagulopathy, activation of the complement system or increased peripheral sequestration. It has been shown in vitro that platelets cause macrophage-induced phagocytosis in patients with secondary Dengue virus (DENV) infections with an undetected mechanism². Thrombocytopenia is common in patients with mild or severe cases of DENV infection. Studies show that low platelet count is one of the major causes of bleeding in such patients³, and blood transfusion is required in order to maintain normal hemostatic activity. The development of thrombocytopenia in dengue patients depends largely on two events; decreased platelet production in the bone marrow or increased destruction and removal of platelets from peripheral blood⁴.

In addition to their role as the main regulator in hemostasis, platelets may also respond to physiological and inflammatory responses^{5,6}. It is widely accepted that some tumor cells can stimulate platelets^{7,8}. Once activated, platelets release a lot of healthy functional molecules that can measure tumor growth and metastasis^{9,10}. Within the blood compartment, tumor cells can form aggregates with platelets and thus avoid natural killer cell mediated cytotoxicity¹¹. Therefore, adhesion of platelet aggregation and its function is an important step in the survival of a tumor cell within the circulatory system¹². Nowadays chemotherapy is the most widely used treatment for cancer. It is commonly used to treat cancer, but chemotherapy and radiation can damage bone marrow cells that produce blood and platelets. This can lead to low blood cell counts, which can increase the risk of infection or bleeding¹³.

Therefore, when talk about donations and blood transfusions, the two techniques are approachable. Where one is known as single unit of platelets (SDP)

and the other is a mega unit of platelets or Platelet apheresis. In fact, apheresis is a Greek word meaning to remove or to separate. Plateletpheresis is a procedure in which the donor removes platelets from whole blood and extracts and replenishes residual blood components in the donor. The cell separator is used as the primary tool for collecting platelet concentrations. In chemotherapy protocols, the use of a single platelet (SDP) focuses, in particular, reducing the transmission of alloimmunization and viruses in patients given reduced levels of exposure to donors¹⁴.

Concerns about the health of platelet donors, can be easily verified by comparing the hematological indices of platelet donors before and after plateletpheresis. As these hematological variations might result in clinical problems such as thrombocytopenia and anemia among donors. Hence, the present study aimed to investigate the changes in hematological values before and after platelet apheresis in healthy donors.

Methodology

This cross sectional study was conducted at Fatima Memorial Hospital (FMH) in Lahore, Pakistan including one hundred CBC samples of healthy platelet apheresis donors before and after plateletpheresis procedure. The diagnostic tests were performed at Indus Laboratory in Latif Hospital, Lahore-Pakistan. The study was ethically approved by the hospital's ethical review committee (Ref No: IRB-UOL-FAHS/716-VI/20202; Dated 03-03-2020) and commenced in accordance with the Declaration of Helsinki.

All those donating platelets by platelet apheresis via mega unit were considered eligible. Furthermore, the apheresis donor should not have consumed aspirin in the last 48 hours, they should be healthy, physically and mentally fit. Donors suffering from any disease like, anemia, heart disease, liver or kidney failure were kept under the exclusion criteria. The clinical history of all the donors was obtained before the platelet apheresis procedure to ease the donor selection process. Platelet apheresis was done by mega unit

Haemonetics MCS+9000 Cell Separator and 994-CFE. The sample included a specific blood concentration from the donor's circulatory system and the anticoagulant sodium citrate was then added to it in the ratio of 1:12¹⁵. The homological indices were compared before and after plateletpheresis.

The analysis of the data was done on SPSS version 26.0 and presented using mean \pm SD. A paired sample T-test was used for pre and post-test

assessment and a p-value < 0.05 was considered significant.

Results

Table 1 shows the comparison of hematological parameters before and after donation. Apparently after platelet apheresis procedure, a significant decrement in PLT value was observed ($p < 0.001$). Furthermore, a remarkable difference in the mean Hb, MCH and MCHC values pre and post plateletpheresis was observed.

Table 1: Comparison of mean hematological values of pre and post plateletpheresis.

| Parameters | Pre Donation | Post Donation | Mean Difference | p-value |
|-------------|-------------------|--------------------|-------------------|---------|
| | Mean \pm SD | | | |
| RBC | 5.60 \pm 0.44 | 4.74 \pm 0.41 | 0.86 \pm 0.02 | <0.01 |
| WBC | 8.82 \pm 0.55 | 8.16 \pm 0.42 | 0.65 \pm 0.13 | <0.01 |
| MCH | 31.15 \pm 1.62 | 27.97 \pm 1.70 | 3.18 \pm 0.07 | <0.01 |
| MCHC | 34.45 \pm 0.93 | 31.51 \pm 1.24 | 2.93 \pm 0.31 | <0.01 |
| Hb | 15.75 \pm 0.59 | 13.97 \pm 1.38 | 1.78 \pm 0.78 | <0.001 |
| PLT | 299.0 \pm 24.54 | 158.56 \pm 20.30 | 140.43 \pm 4.23 | <0.001 |

RBC-Red Blood Cells; WBC-White Blood Cell; MCH-Mean Cell Hemoglobin; MCHC-Mean Corpuscular Hemoglobin Concentration; Hb-Hemoglobin; PLT-Total Platelet Count (PLT)

Discussion

During the last few years there have been many upgradation in the procedure of platelet apheresis, a number of studies have investigated the quality and biological contribution of platelet count of the donors^{16,17}. The present study described the hematological changes before and after the procedure of platelet apheresis. Such changes in hematological parameters might result in severe clinical outcomes such as thrombocytopenia and anemia, so the alterations beyond the optimal ranges should not be ignored. The donors that have low pre-donation platelet value (150 – 200 $\times 10^9/L$) or Hb value (12.5 – 13 g/dl) should be monitored keenly to prevent anemia and associated complications.

In the present study only one donor had a post-procedure platelet count of $< 150 \times 10^9/L$. Significant decrement in donor's hematological values after platelet apheresis, without any clinical

history and any abnormal symptoms, have also been reported by other researchers. Lazarus and his colleagues studied¹¹, 646 healthy donor's PLT values before and after the procedure of platelet apheresis in 2001 but they did not found any donor with PLT count $< 150 \times 10^9/L$ before the procedure⁷ and a sustained decrement in the platelet count after procedure was reported. The donors having PLT values $< 200 \times 10^9/L$ can become thrombocytopenic after the platelet apheresis. In support, a number of similar studies report a significant decrement in these hematological indices post donation, Sudipta et al in 2009 reported the PLT level between $213.7 \pm 53.16 \times 10^9/L$ (before plateletpheresis) and it reduced to $150.7 \pm 46.77 \times 10^9/L$ (after plateletpheresis)¹⁸. Tiwari and Ayush conducted a study in 2018, plateletpheresis procedure was performed on Fresenius. The CBC parameters of healthy donors both before and after the apheresis procedure were compared. They reported that hemoglobin and platelet parameters drop off after the

apheresis procedure till 12.5-13 g/dl and $150-200 \times 10^9/L$ ¹⁹.

Furthermore, after platelet apheresis, we observed that 3.7% of the donors had the hemoglobin concentration < 12 g/dL, considered anemic rendering to the World Health Organization (WHO) criteria²⁰, irrespective of gender. While, the hemoglobin concentration of three donors was < 10 g/dL, after the procedure of platelet apheresis. It is studied that old apheresis devices cause greater loss of red blood cells during the procedure of platelet apheresis as related to more recent versions. The present research involved the latest single needle technology to avoid such threats. A similar study reported a significant post donation decrement in the Hb concentration, around 8.1% of the enrolled healthy donors had Hb concentration < 12 g/dL¹⁸. Other parameters such as RBC, WBC, MCH and MCHC were also significant different pre and post plateletpheresis procedure ($p < 0.01$).

In Pakistan for the development of broad spectrum technology in the field of blood banking and hematology, this scientific research will be a good help for researchers. Further research is required in order to evaluate the co-factors altering these hematological indices among donors.

Conclusion

Based on the study results, a significant drop in the complete blood count was observed in all the enrolled donors. Nevertheless, many prospective and detailed studies on this topic are required to design the best guidelines for donor's safety in platelet apheresis and also to assist in appropriate donor selection.

Conflicts of Interest

The authors have declared that no competing interests exist.

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