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Analysis of Heamatological Parmeteres in Pre and Post Donation of Platelets in Northern Belt of India

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Abstract

Plateletpheresis is a procedure where the blood from a donner is processed and platelets are separated out and the remaining blood components are return back to the donner. Many studies have been conducted to see the efficiency of cell separators in extracting platelets. The concern of donner safety still remains unattended. With this background the current study is beingundertaken to analyses the effect of plateletpheresis donners hematological parameters along with serum calcium and magnesium were also estimated.

Aims and Objective

1. Objectives of the study was to study the effect of platelets ferries on hematological parameters of donners which are Hb, Hematocrit, platelets, WBC, RBC counts along with MPV and PVW.
2. To study the effect of plateletpheresis on serum calcium and magnesium levels.

Method

Keeping all these intricacies in mind study was conducted on 150 healthy first times donner who underwent plateletpheresis on Haemonetics MCS+ intermittent flow cell separator. Donner were assessed for effect of plateletpheresis procedure on donner hematological parameter.

Results

Statistical analysis was done using paired t test mean value of ACD infused in this procedure was

339.1±38.51ml (237-458ml).

Conclusion

Plateletpheresis is safe and acute reaction rate is less than blood transfusion Current procedure suggested that apheresis donation may affect hematological parameters like Hb, HCV, platelet count, RBC count, WBC count along with calcium and magnesium.

Introduction

Platelets transfusions are used in the treatment and prevention of bleeding in patients with decreased number or level of platelets. It is used as means of hematological supports in cancer treatment as well as in patients of dengue, leptospirosis and malaria etc. platelets transitions are expensive and associated with a number of side effect like febrile reaction, transmission of viral and bacterial reaction fluid overload, graft v/s host diseases, hemolysis and immunization single doner platelet (SDP) products are preferred over random doner platelets (RDP) both of this increase the platelets count by 5,000 to 10,000/µl. It is also used in patients who need human leucocyte antigen (HLA). Several studies have been conducted to investigate the quality of platelet concentrate however, safety issues with regards to post procedure platelet counts various hematological investigation were carried out. Crocco et al conducted a study in two Italian transfusion centers from January 2002 to December 2002. To evaluate frequency and type of adverse reaction were recorded in 0.28% of all donation in donner. Despotis et al studied the adverse events in donation of platelets from 1993 to 1997. They concluded that plateletpheresis procedure have 150-fold higher incidence of serious adverse reaction requiring hospitalization. But their study did not reviled cause- effect relationship between platelet donation and ACS. Love et al in 1992 found Hb raised from 14.73±0.79 to 15.25±0.92 gm/dl., mean platelet decreased from 258±42.7 to 229.2±36.8 and mean WBC increased from 5.30 to 5.55. Beyan et al in Gulhane Military Medical Academy, Ankara carried out study on 265 healthy donner with in 1 hour after procedure. There was decrease in mean Hb from 14.92±0.97 to 14.0±0.98gm/dl. Das et al carried-out study on 457 donner. Significant decreased in Hb, hematocrit, platelet and WBC counts. Tendulkar et al is found post donation platelets count is decreased. Suresh et al in 2012 found significant decreased in platelet count($p<0.001$). Gite et al in apollo hospital showed reduction of platelet count $81.980x10^9/L$ in donner. Kailash et al at Farmington did a study on 67 donors it was found that after and average donation the mean platelet count decreased significantly($p<0.01$). citrate causes interference in ionic balance with positive ion like magnesium.Solankhi et al (2015) studied serum cation level during 60automated plateletpheresis procedure at Lucknow. Fresenius and 19 on Haemonetics MCS+ using ACD-A anticoagulants in ratio of 1:10-1:12 and blood flow rate of 60-80ml/minute were carried out of 60. They found gradual decreases in mean total of calcium and magnesium. V B mane et al used 62 donners and all procedure were performed on Fenwal Amicus cell separator using ACD anticoagulant.

Material and Methods

The present study was carried out on 150 healthy donner November 2021 to November 2022 to analyses the hematological parameters along with serum Ca ang Mg levels. To blood sample were collected from each donner before the procedure,1 in EDTA vial for estimation of hematological parameter and other in plan vial for serum calcium and magnesium. Anticoagulant used was ACD-A in the

ratio of 1:9 and blood flow rate of 80 ml/minute.

Specific criteria for selection of donners

- No aspirin medication within 7 days
- Interval between procedure 48 hours
- Platelet count is done before each procedure
- Total plasma proteins should not be less than 6 gm/dl

Exclusion criteria

- H/o of any medication including calcium supplementation
- Current h/o of blood donation in last three month
- H/o of minor surgery in last three months
- H/o BT in last 12 months
- H/o any major surgery in last 3 months
- H/o ear piercing or tattoo in last one year
- H/o any high-risk behavior

Logistics aid

- Sysmex cell counter was used on the principle of electrical independence. In this, cells are sized and counted by detecting and measuring changes in the electrical resistance when a particle passes through a small aperture.
- Siemens kit was used for testing magnesium which is a modification of methyl thymol blue complexometric method.
- Siemens kit was used for testing calcium. In this calcium reacts with OCPC two form a purple complex.

Observation

The results of this prospective study which was conducted on 150 healthy first-time donors the hematological parameter and biochemical levels gave us the following information: -

All the donor were 80-60-year age with majority is 30-45 they had 60-70 kg weight. Out of 150 donor's majority were of o+ groups (29.3%).

Figure 1 Age Distribution Of Donor.

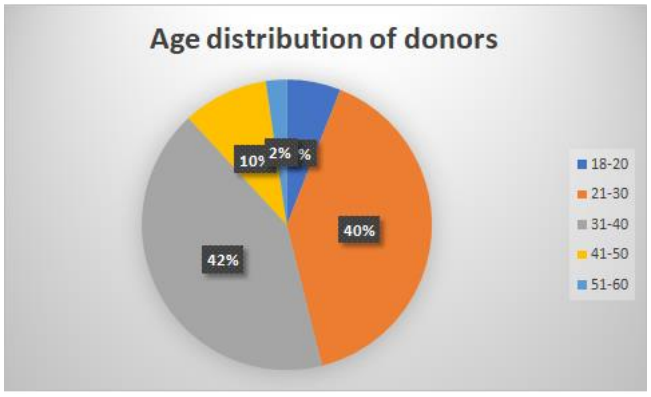


Figure 1 Age distribution of donors

There was an increase of 0.14gm/dl in mean post donation Hb level ($p<0.01$).

Figure 2 Variations on Pre and Post Donation Hb of Donors.

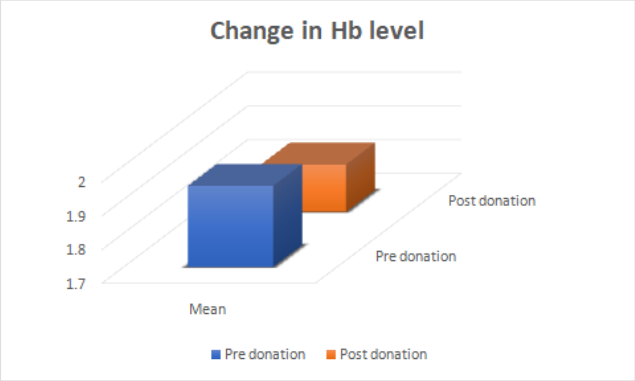
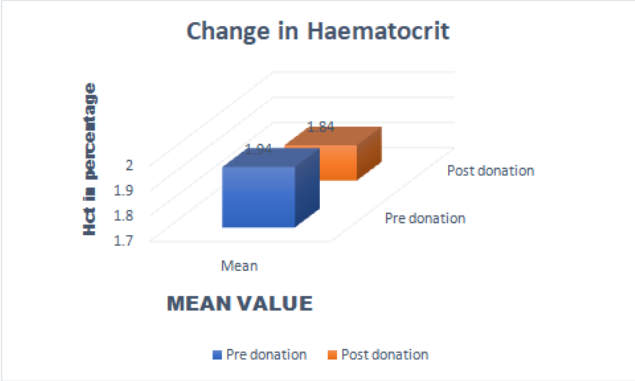


Figure 2 Variations on Pre and Post Donation Hb of Donors.

HCT of donor population showed an increase of 0.33% the post donation increase was statistically significant $p<0.05$.

Figure 3 Variations in Pre and Post Donation Hematocrit of Donor.



Post donation decrease of mean platelet count was found to be statistically highly significant $p<0.001$.

Figure 4 Variations in Pre and Post Donation Change in Platelet Count of Donor.

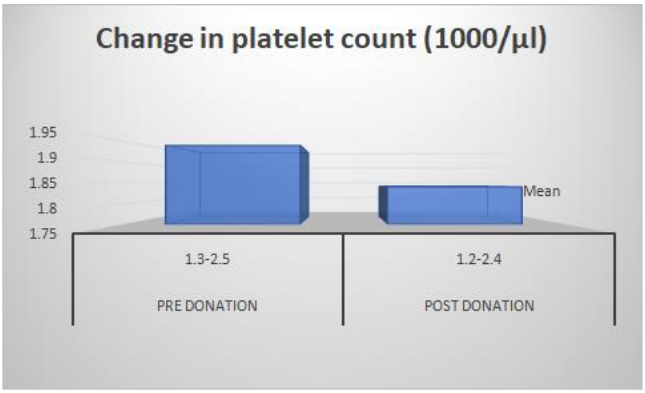


Figure 4 Change In Platelet Count

There was post donation deceases in WBC count of 4.02% which was statistically significant ($p<0.001$)

Figure 5 Variations in Pre and Post Donation Changes in WBC Count of Donor.

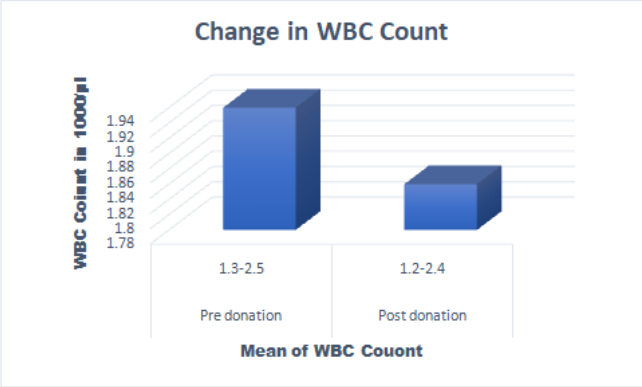


Figure 5 WBC Count in pre and post donation

Post donation increase in mean MPV was 0.06(0.7%) which was not statistically significant p=0.486

Figure 6 Variations in Pre and Post Donation Change in MPV of Donor.

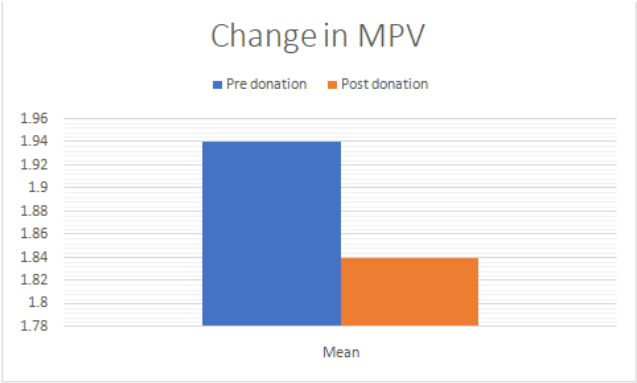


Figure 6 Changes in MPV

The post donation decrease in mean PDW was 0.13 (0.98%) which was not statistically significant p=0.477

Figure 7 Variations in Pre and Post Changes in PDW of Donor.

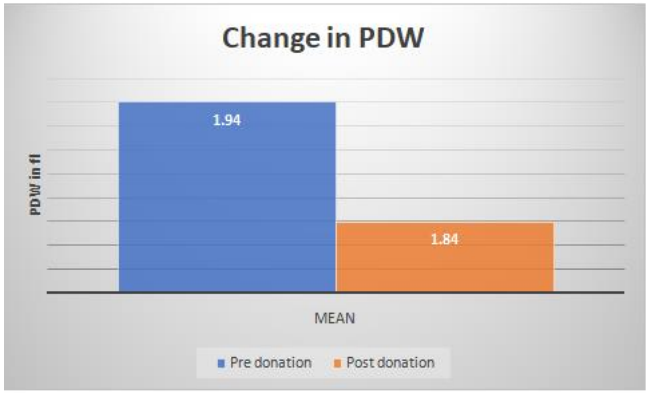


Figure 7 Changes in PDW

There was post donation increase in mean RBC count was 1.3% which was statistically significant (p<0.001).

Figure 8 Variations in Pre and Post Donation RBC Count of Donor.

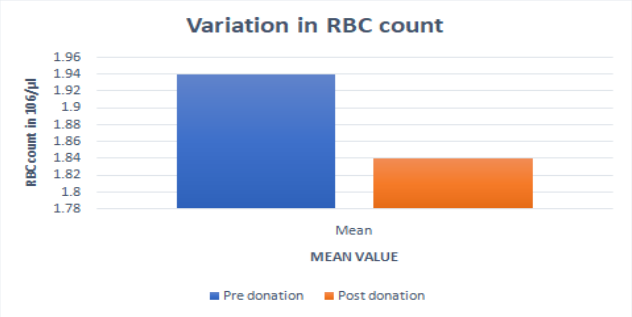


Figure 8 variations in pre and post donation RBC count

The post donation decrease in mean serum calcium walls 0.15 (1.5%) which walls statistically highly significant (p<0.001).

Figure 9 Variations in Pre and Post Serum Calcium Level of Donor.

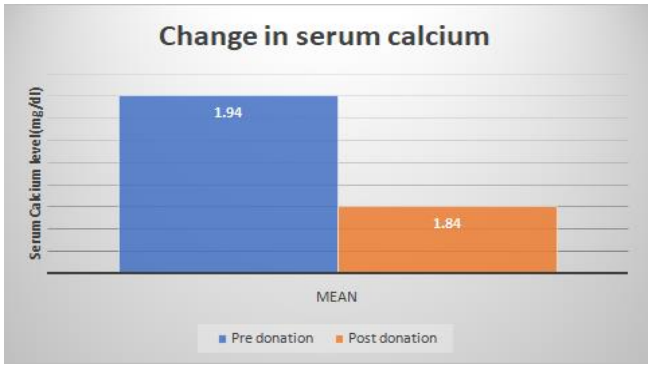


Figure 9 Change in Serum calcium level

The post Donation decrease in mean serum magnesium was 0.1(5.1%) which was statistically highly significant (P<0.001)

Figure 10 Variations in Pre and Post Serum Magnesium Level of Donor.

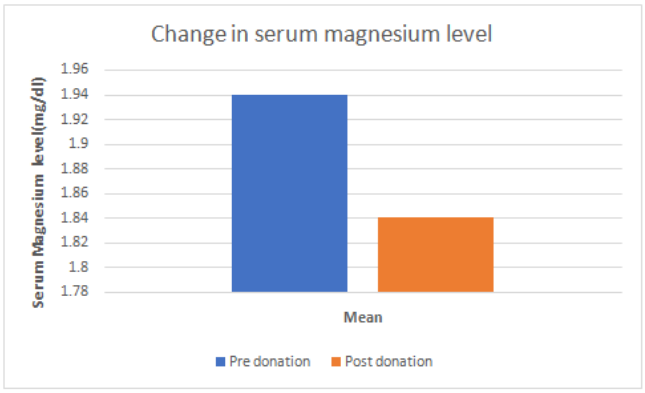


Figure 10 Change in serum magnesium level

Discussion

The present study pause conduct conducted in the in the department of immunohematology you know and blood transfusion at MM institute of Medical Sciences and research in the department of biochemistry. S nearly all red blood cells and white blood cells can be return to the donor, it is a common practice to repeat apheresis donations at close intervals. This could result in a large cell loss that might lead to transient clinically significant problems in donors. This study included 150 plateletpheresis procedures in which donors what evaluated for pre and post donations hematological parameters.

Post donation clinical changes in donor Hb and Hct and RBC count

In our study we observed statistically significant increase in donors post donation Hb, Hct, RBC count (P value<0.05). Mean pre donation HB of the donors was 14.59±1.17g/dl (12.2-17.3 g/dl) and mean post donation Hb was 14.74±1.20g/dl with an increase of 14g/dl (0.95%). Mean Hct of the donner was 42.94 ±3.43% and mean post donation Hct was 43.28±3.55% with an increase of 0.33%. the mean pre donation count was $5.06x10^6$/µl and the mean post donation RBC count was $5.13x10^6$/ul±0.43. increase in Hb, Hct and RBC count was statistically significant. This result in slight hemoconcentration in the donner because only platelets are collected along with 200-300 ml of plasma and rest component are return back to the donner. these finding match with the study of Sachdeva et al who observed Hb by 1.7% and Hct by1.5% which was statistically significant. Love et al reported an increase in post donation Hb from 14.73±079g/dl to 15.25±0.92g/dl similar increase in Hct vale from 0.41±0.02 to 0.43±0.02. this is in line with our study. Suresh et al found statistically significant decrease in post donation Hb from 14.8±1.097to 14.5±1.4g/dl and Hct from 43.29±6.62 to 41.64± 4.96 a decrease in RBC count p value<0.053 but this was not significant our study is known concordant with this study. S S Das et al found significant reduction in Hb from 13.9±1.08 to 12.6±4.74/dl and Hct from 40.08±4.01 to 38.9±3.41. Tendulkar et al in her study found 2.9% decrease Hb and 3.1% in Hct.

Effect of platelet pheresis on platelet count

On our study pre donation platelet count was $266.75±50.73x10^{3/ul}$and post donation platelet count was $193.4±43.38x10^3$/ul. A mean decrease of 27.5% was seen which was statistically highly significant(p<0.001). this resembled study of Sachdeva et al in which they also observed a 30% decrease in platelet count from 241±57.3to $170.28±48.86x10^3$/µl. Love et al also reported a fall in platelet count from 258.6±42.7 to $229.2±48.86x10^3$ in their study which included 112 procedures. This decrease was statistically significant. Similar findings were made by das et.al in their study. Platelet count decreased from 209.7±53.60 to 150.7± 46.7x103 per microliter. The result was highly significant. Lazarus et al studied the effect of long-term regular platelet pheresis on donor platelet count. There was stained decrease in platelet count.

Effect of platelet pheresis on post donation WBC count

Mean WBC count in our study decrease from $7.46±1.43x10^3$ per microliter to $7.1±5.2x\ 10^3$ per microliter. A mean decrease in WBC count by 4.02 percent which was statistically significant. This was observed because blood components contain donor

leukocytes. This was concordance with Suresh et.al who observed significant decrease in post donation WBC count ($p<0.001$). Das et al also observed WBC count decrease significantly ($p<0.001$) in donors after each procedure. Sturass studied effects of repeated WBC loses on platelet pheresis donors and observed modern cell separators produce a pure platelet concentrate, each procedure leads loss of $1x10^6$ to $5x10^7$ leucocytes.

Effect of platelet pheresis on MPV and PDW

In our study mean MPV increased from 9.71±1.53 fl to 9.77±1.75 fl and PDW decreased from 13.15±3.25 fl to 13.01±3.01 fl which was not statically significant. This observation was in agreement with the study by the das et.al in which they found that both MPV increased and PDW decreased were not significant. Sachdeva et al also observed that changes in post donation MPB and PDW were not significant.

Effect of platelet pheresis on serum calcium and magnesium

A mean decrease of 0.15 milligram per deciliter (1.5 %) was seen was highly significant. Mean pre donation serum magnesium was 1.94±0.25 mg/dl and mean post donation serum magnesium was 1.84±0.24 mg/dl. Mean serum magnesium levels decreased by 0.1 mg/dl (5.1%) which was statically highly significant. This was in concordance with a study by Solankhi et al. decrease serum calcium level decrease from baseline of 9.83±0.65 to 9.42±0.54 after thirty minutes of procedure. Similarly, serum magnesium level decreased from 2.36±0.30 at the start of procedure to 2.25±0.25 after thirty minutes. This decrease in serum calcium and magnesium levels was clinically significant. Mercan et al observed that serum magnesium and calcium levels were decreased that was highly significant. Das et al studied changes in total and ionized serum magnesium and calcium levels and observed that mean total calcium and magnesium decrease was not significant. Bolan et al observed that ionized calcium level decrease by 23 %, 30% and 33% after the procedure. Similar results were seen by Mane et al.

Summary and conclusion

This study was undertaken to analyze the changes in hematological parameters and serum magnesium and calcium levels of donors after platelet pheresis. The data was collected prospectively. The following features was highlighted in this study:

1. Mean age of donors was 30.45±8.005 years (18-55 years) maximum donors were in the age group of 21 to 30 years (42%).
2. All donors were male.
3. Mean weight of donors was 70.34±6.71 kg (62-85 kg).
4. Maximum donor were blood group B+ (42%).
5. Mean ACD infused during the procedures was 339.1±38.51ml (237 to 248 ml).
6. An increase of 0.14 g/dl of HB was seen after the procedure which statically significant ($p<0.001$).
7. Mean pre and post donation Hct of donors was 42.94±3.53% and 43.28±3.55% respectively. This was statically significant ($p<0.05$).
8. A decrease in platelet count from 266.75±50.73x 10^3 per ml to 193.43±43.38x10^3 ml which was highly significant ($p<0.001$).
9. post donation decrease in the mean WBC count was 0.30 (4.02%) which was significant ($p<0.001$).
10. Mean RBC count of donors increased from 5.06±0.54x 10^6 ml to 5.13±0.43x10^6 per ul. This was highly significant ($p<0.001$).

11. In increase in MPV was from 9.71±1.53 fl to 9.77±1.75 fl which was not significant.
12. Mean PDW decreased from 13.15±3,25 fl to 13.01±3.01 fl, it was not significant.
13. Mean serum calcium decreased significantly from 9.91±0.39 milligram per dl to 9.75±0.38 per dl (p<00.1).
14. Significant decrease in mean serum magnesium was from 1.94±0.25 milligram per dl to 1.84±0.24 mg/dl (p<00.1)

Platelet pheresis on cell separators is safe and the acute reaction rate is less than whole blood donation. However, recent evidence suggest that apheresis donations may produce changes in hematological and biological biochemical parameters of the donors like Hb, Hct, platelet count, RBC count, WBC count, serum calcium and magnesium. Additional research solicited to a certain the risks of long-term apheresis donation.

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