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Changes In Hematological Values In Donors Who Undergo Plateletpheresis

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Abstract:
Introduction: *Technical advances in automated cell separators have substantially improved the productivity and quality of the collection of apheresis platelets. Various studies on automated plateletpheresis have been conducted to investigate the quality of platelet concentrates and their relation to the biological contribution (platelet count and/or total mass) of the donor. Apheresis separates the blood into these components while the donor is still connected to the separation device. A rotating centrifuge or a rotating belt separates the donor's whole blood into its components based on density.*
Materials And Methods: *The present prospective study was carried out in IMA Blood Bank Dehradun Uttarakhand. The present study was carried out to evaluate the platelet collection from apheresis devices and compare the efficiency of platelet collection processing time, platelet yield, and ACD used. All plateletpheresis procedures were performed following the departmental standard operating procedure using a closed system apheresis kit and ACD-A anticoagulant in the proportion of 1:12. The endpoint of each procedure was based on the target yield of 3x10¹¹ platelets per unit maintaining a blood flow rate for all collections at 50-80 mL/min. To measure the pre-and post-donation hematological values, whole blood samples were collected in EDTA vials just before and within 30 minutes after the procedure. Parameters such as Hb concentration, Het, platelet and WBC counts, mean platelet volume (MPV), and platelet distribution width (PDW) were measured on a calibrated automated analyzer.*
Results: *The mean value of platelet count dropped significantly post-donation. Similarly, the mean Hb level before apheresis was 15 g/dl with the range of 12.5-20.9 g/dl and after apheresis 14 g/dl with the range of 10.2-19.5 g/dl the mean value of Hb dropped marginally in post-donation and the mean WBC count before the apheresis is 8 X 10³ /mm³ with the range of 3.9-15.1 X 10³ /mm³ and after apheresis, it is 7 X 10³ /mm³ with the range of 3.8-15 X 10³ /mm³. There was no change in PDW and MPV before and after the apheresis. In the SN procedure, the mean platelet count pre-donation was 241.52 lac/µL with a range of 152-478 lac/µL the mean platelet count post-donation was 169.59 lac/µL with a range of 71-335 lac/µL the mean platelet count in DN procedure pre-donation was 247.88 lac/µL with a range of 144-448 lac/µL and post-donation 173.50 lac/µL with a range of 53-367 lac/µL the mean platelet count dropped significantly following apheresis procedure the mean platelet count between either of the procedure was not significantly different.*
Keywords: *Plateletpheresis, Apheresis, Platelet, Blood, Donation.*

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I. INTRODUCTION

Technical advances in automated cell separators have substantially improved the productivity and quality of apheresis plateletscollection. Numerous studies have been conducted on automated plateletpheresis to determine the relationship between the donor's biological contribution (platelet countortotal mass) and the platelet concentrates'quality [1]. On the other hand, traditional blood donation involves taking a unit of blood from a donor and sending it to a lab, here it is divided into 4 components: Red Blood Cells,White Blood Cells, platelets, and plasma which are stored and, given to patients after surgerybased on the medical requirement, following chemotherapy,an illness, oraccident. While the donor is still attached to the separation apparatus, apheresis separates the blood into these parts. The entire blood from the donor is divided into its constituents based on density using a rotating centrifuge or a rotating belt.[2]

Apheresis

Apheresis is a medical procedure involving the removal of whole blood from a donor or patient and dividingthe blood into separateconstituentsallowing for the removal of a specific component. The remaining constituentsof blood are then administered back into the patient's or donor'sbloodstream. Apheresis is utilizedfor the blood components collection of donor (such asplasma or platelets) andto remove a portion of the blood that contains disease-provoking factors in order to treat some medical disorders. Patient's or donor'sblood is sent to machine via tubing which separates the various components of the blood in all apheresis treatments. The separation ofvarious components of the blood is made in the machine by using a filtration/centrifuge process. Following the separation, the desirable blood component is removed, and the remaining are transferred back to the patient. The whole process is painless and usually lasts 2 hrs, which is a little bit longer compared to conventional blood donation. [3]

II. Materials & Methods

The current prospective research was done in IMA Blood Bank Dehradun Uttarakhand inMarch. 2022 to Dec. 2022. The goal of the present research was to determinethe collection of platelet from apheresis devices and compared the effectiveness of processing time of collection of platelet, ACD usage, andyieldof the platelet. A total 240 donors were involved in the apheresis process, of which 71 underwent SN & 169 underwent DN apheresis, with 11 female and 229 male donors.

The selection of the donor-cell separator was dependent upon its accessibility at the time of the procedure. The fresinius.com tec separator was used throughout the procedure by the same resident doctors.

A closed system apheresis kit and 1:12 ratio of ACD-A anticoagulant were used for all plateletpheresis procedures in accordance with the department's standard operating procedure. Each procedure's endpoint has beenbased on $3x10^{11}$ platelets per unit target yield while keeping a 50–80 mL/min rate of blood flow for all collections. Whole blood samples were taken in vials of EDTA shortly before & 30 minutes after the process to measure the haematological parameters before and after the donation. A calibrated automated analyzer has been used to assess parameters likeHet,plateletcount, Hb concentration, and WBCs,MPV ("Mean Platelet Volume")&PDW ("Platelet Distribution Width").

Statistical software called SPSS was used to analyze the data. The comparison between the pre-and post-haematological data was done using Spearman correlation.

III. Result & Observation

The study involved 240 healthy first-time donors who underwent plateletpheresis using Fresenius com. Tec. The majority of the donors were between the ages of 21 and 30 (52%) on both aphaeresis procedures DN and SN method, followed closely by donors between the ages of 31 and 40 (35%). Very few donors were between the ages of 20 and 50. The majority of donors (87%) were between the ages of 18 and 40, while just a small percentage (13%) were found to be between the ages of 41 and 60.

A total 240 donors were involvedin apheresis, of which 229 (95%) were men and 11 (5%) were women. 169 patients had DN apheresis whereas 71 got SN apheresis.

According to the statistics above, the majority of donors for PHPL were male: 99.41 percent of DN donors were men, and 85.92 percent of SN donors were women. The female donor populations in DN and SN procedures were 0.59 percent and 14.08 percent, respectively. In comparison to the DN process, there were slightly more female donors in the SN procedure (14.08 percent).

Comparison of pre-and post-donation mean haematological values

HAEMATOLOGICAL VALUES	PRE PLTPHERESIS	RANGE	POST PLTPHERESIS	RANGE
PLTCOUNT (lac/ųl)	246	144-478	172	53-367
HB(g/dl)	15	12.50-20.90	14	10.20-19.50
WBC COUNT (cu/mm)	08	3.90-15.10	07	3.8-15
MPV (fl)	09	6-13	09	7-13.1
PDW (%)	13	8.5-18	13	8.4-18

Table no.1**Comparison of pre-and post pltpheresis mean haematological values**

The platelet count ranged from 144-478 lac/ųl with a mean value 246 lac/ųl before apheresis, while after apheresis, the range varied from 53-367 lac/ųlwith a mean value 172 lac/ųl. After donation, the platelet count'smean decreased considerably.Similar to this, the mean value of Hb level was 15 g/dl before apheresis

havinga 12.5-20.9 g/dl of range and 14 g/dl mean Hb level after apheresis with a 10.2 to 19.5 g per dl of range.TheHb'smean decreased slightly after donation, and the mean WBC count was 8 X 103/mm3 before the apheresis and 7 X 103/mm3 thereafter. While the range varied from 3.9-15.1 X 10^3 /mm^3 before the apheresis and from 3.8-15 X 10^3 after the apheresis. MPV and PDW did not vary before or after the apheresis.

According to procedure type DNand SN:Comparison of pre/post-PHPL mean haematological values

In the SN process, the platelet count range varied from 152-478 lac/ųL with a mean value of 241.52 lac/ųL in pre donation while in post-donation the mean value of platelet count was 169.59 lac/ųL having a range varied from 71-335 lac/ųL.In the DN procedure,the platelet count varied from 144-448 lac/ųL and the mean was 247.88 lac/ųL in pre-donation while the range varied from 53-367 lac/ųL with a mean platelet count post donation of 173.50 lac/ųL.Theplatelet count'smean value decreasedconsiderablyafter apheresis process.No discernible variation in the mean platelet count was found between both procedures.In SN process, the Hb pre-donation ranged from 12.5 to 18.4 g/dl, while the post-donation ofHb ranged from 10.2 to 18.2 g per dl. Pre donation mean value of Hb was 14.67 g/dl while post-donation was 14.7 g/dl.In DN process, the Hb pre-donation ranged from 12.5-20.9 g/dl, while the Hb post-donation ranged from 12-19.5 g per dl. Pre donation Hb'smeanwas 15.6 g per dl while post donation value of Hb'smean was 14.6 g/dl. Following the apheresis procedure, the mean Hb decreased significantly.There was not any discernible difference in the mean Hb level between the two procedures.WBC count, PDW, and MPV did not alter after each procedure.

Before apheresis, the platelet count'smean was 246lac/ųL, and after apheresis, it was 172 lac/ųL. In post-donation, the mean platelet count decreased considerably. Similar to this, the Hb level'smean before and after apheresis was 15 g/dl & 14 g/dl respectively. In post-donation, the Hb'smean value decreaseda little bit and the WBC count'smean value is 8 X 10^3/mm^3 and 7 X 10^3 /mm^3before and after apheresis resp. There was no variation in MPV and PDW both before & after apheresis.

IV. Discussion

In the present study,the pre and post-apheresismean Hb count was 15 g/dl and14g/dl respectivelywhile the pre and post-apheresismean WBC count 08 X 10^3 /mm^3 and 07 X 10^3 /mm^3 respectively reported pre-WBC count 7200/ųl and pre-Hb 15.05 g/dl. It was also seen that after PHPL; HB, WBC, & platelet count reducedconsiderably.The results are in agreement with the findings of the current study therefore the haematological parameter in donorshave to be carefully checked who isbelievedshould regularly go through "long-term apheresis"and prevention for the development of artificial anemia that is likely to occur and cell separator system selection be based on this possibility.[4]

According to [5], the overall mean value for both procedures was 306 ml, with the SN procedure's mean value of ACD being 324.87 ml and the DN procedure's mean value being 297.75 ml. reported 482 ml and reports "417.58±71.36 ml"utilization in the apheresis processchanges in the amount of ACD used may be caused by the various makes and models of the apheresis devicesutilized, such as (continuous flow centrifugation (CFC) or intermittent flow centrifugation (IFT)), as well as alteration caused by the procedure type's variable donor distribution (SN and DN). [6]

In the current investigation, the mean product yield was "3.10 X 10^{11} /L in SNand 3.13 X 10^{11} in DN", overall 3 X 10^{11} /L. According to [7], 3.1 x 10^{11} /L [8] noted 3.11 ± 0.40 x10^{11} /L value. In com.tec, [9] noted2.90 ± 0.54 X 10^{11} /L, and in amicus [10] reported 5.03 X 1011 /L. [11] noted 3.3 X 1011 /L in com.tec; the results are quite similar to those of the current investigation. The product yield's mean value in the current research was 3.10 X 1011 /L in SN and 3.13 X 1011 /L in DN, both of which are in close agreement with [12], who reported the values as 4.1± 0.3 X 1011 /L and 4±0.3 X 1011 /L, respectively.

V. Conclusion

The "student t-test" was utilized to compare the mean yield of the platelet with the mean platelet countpre-donation, and the value of p of 0.06 indicated that there was no statistical significance.

The "overall mean value" of different parameters in the current research wasdetermined, and the "student t-test" was used to determine the significant value. Out of all the parameters, the procedure's time was observed to be significant with a p of <0.00value, and the volume of ACD utilized was also shown to be significant with a p of <0.001value.

In the present study, 240 donors underwent donation over the course of the six-month study period; 35 were deferred temporarily, and 9 were deferred permanently for a variety of reasons. The most frequent reasons for deferringthe donor for the donation were "platelet count"under 1.5 lac/L (10 deferred), and "Hb below 12.5g/dl"value.

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Conflict of Interest: None

Ethical approval: Ethical clearance was sought from NIMS University Institutional Ethical Committee (NIMSUR/IEC/2022/223) Jaipur, Rajasthan, India.

Author Contribution: All authors contributed equally & significantly to this paper. All authors have approved and read the manuscript'sfinal version

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