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RESEARCH ARTICLE

A PROSPECTIVE STUDY OF FACTORS RELATED TO PLATELET YIELD AMONG DONORS UNDERGOING PLATELETPHERESIS.

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Abstract

Background: The transfusion of blood products is life saving especially at emergency conditions. The platelet transfusions helps in prevention of bleeding related complications and thus prevents morbidity and mortality in thrombocytopenic patients. Platelets are transfused by two methods i) by fractionation of whole blood and ii) by platelet apheresis. The quality of single donor platelets (SDP) in terms of yield influences platelet recovery in the recipient.

Material and Methods: A sample of 360 donors were included in the study over a period of one and half year. Various donor-related factors were meticulously recorded prior to performing plateletpheresis. The aim was to identify donor factors that influence platelet yield. The plateletpheresis procedures were performed using Trima accel machine. A relationship between pre-donation donor variables and yield of platelets was studied using the Pearson correlation.

Results: The mean platelet yield was $2.29 \pm 0.43 \times 10^5/\mu\text{L}$ per donor. A positive correlation was observed between platelet yield and pre-donation platelet count, body mass index (BMI; Kg/m²) of the donor, while a negative correlation was observed between age and the platelet yield.

Conclusion: Donor pre-donation platelet count, BMI and donor age influence platelet yield. Young healthy donors with a high platelet count and better BMI can give a better platelet yield in the SDP.

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Introduction:-

Platelets are essential for the formation of primary haemostatic plug and maintenance of haemostasis. Approximately 2.2 million platelet doses are transfused annually in the United States (1). A high proportion of these platelet units are transfused prophylactically to reduce the risk for spontaneous bleeding in patients who are thrombocytopenic after chemotherapy or hematopoietic progenitor cell transplantation (HPCT) (2,3). Either a pool of 4 to 6 units of random donor platelet or 1 unit of single donor platelet (SDP) is transfused (4). One unit of SDP should contain a minimum of 3×10^{11} platelets as per American Association of Blood Bank (AABB) guidelines (11) while European guidelines advocate that one SDP should contain 2×10^{11} platelets (5,6). Unlike other blood components, platelets must be stored at room temperature, limiting the shelf life of platelet units to only 5 days because of the risk for bacterial growth during storage. Therefore, maintaining hospital platelet inventories is logistically difficult and highly resource-intensive (7,8). Platelet transfusions can be done either as i) a pool of 4 to 6 units of random donor platelet, or ii) 1 unit of single donor platelet (SDP) is transfused (4).

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Plateletpheresis (apheresis= to remove) is a procedure designed to collect large number of platelets from single donor thereby giving more consistent product (9). As per guidelines of American association of blood banks plateletpheresis (Single Donor Platelets) unit must have platelet count of 3×10^{11} which in turn raises platelet count by 30,000-60,000 per micro litre and is equivalent to 4-6 units of random platelet concentrates (10). Compared to whole blood donation, apheresis has advantages for the donor, such as there is lesser loss of red blood cells. However, apheresis can also lead to specific adverse events such as citrate toxicity or, for single needle devices, extracorporeal circulation reactions (11-13). Platelet transfusion success depends on rational use of platelet components and on the quality of the component. Platelet recovery in a patient is influenced by the transfused dose of platelets which in turn is dependent on the platelet yield.(14) The possibility of obtaining higher platelet yields has important clinical implications: it reduces frequency of platelet transfusions and number of donor exposures with important consequent clinical and economic advantages.(15,16)

Material and Methods:-

This is a prospective case study conducted from August 2015 to December 2016 at tertiary care centre in North India. A total of 360 healthy donors comprising of 359 men and 1 woman with mean age of 41.8 years were selected from plateletpheresis donor registration. With the exception of the donation interval, the requirements for apheresis and whole blood donation are the same. Apheresis donors must meet the requirements for whole blood donation and additionally satisfy criteria that are particular to the selected apheresis. Donors that were less than 18 years and more than 60 years, or were on any medical treatment 7 days prior to the procedure were excluded in this study. Blood samples were collected from donors before and after apheresis procedure. Informed consent was obtained from all donors. Donor screening is required to ensure a safe transfusion for the recipient. Prospective donors must complete several steps before actual platelet donations, including physical examination, a donor history questionnaire, and testing for transmissible diseases. The American Association of Blood Banks (AABB) recommends that prospective donors receive physical examinations including an assessment of weight: hemoglobin, hematocrit, ABO and Rh typing; and inspection for marks from intravenous drug use. Tests are performed for the presence of syphilis, human immunodeficiency virus (anti-HIV-1/2 and HIV-1 RNA), hepatitis C virus (anti-HCV and HCV RNA), hepatitis B virus (HBsAg and anti-HBc). Further, the platelet counts of plateletpheresis donors must be $>150 \times 10^3$ per μl [32]. Individuals can donate 3 days after ingesting aspirin-related medications.

Apheresis was performed using Trima (Gambro BCT, Lakewood, CO). Acid-citrate-dextrose formula was used as anticoagulant during procedures according to the manufacture's recommendations.

All procedures were completed successfully with peripheral venous access . Cubital vein was used for access. All procedures done were single needle. The procedure was continuous and automated. The blood pump speed was set at of 60-80 ml/min . Blood pressure (BP) and pulse were monitored at frequent intervals during the sessions and donors were closely observed for development of any complications and overall status.

Results:-

The results obtained are tabulated below :

Table 1:- The distribution of hemoglobin in the donor of study sample (n=360).

Hb (g/dl)	No. of donors	%age
12-13	27	7.5
13-14	51	14.1
14-15	111	30.8
15-16	105	29.1
16-17	57	15.8
>17	9	2.5

The maximum number of patients had hemoglobin in the range of 14-15 g/dl and 15-16 g/dl, depicting the donors overall had been derived from healthy population. Only where donor constraint was an issue , selection was done in the Hb range 12-13 g/dl and > 17 g/dl.

Table 2:- The distribution of Hematocrit in the donor of study sample (n=360)

Hct (%)	No. of donors	%age
<40	48	13.3
40-45	198	55
45-50	99	27.5
>50	15	4.1

The haematocrit of the donor population were between 40-45% in maximum number of donors.

Table 3:- The distribution of pre-platelet count in the donor of study sample (n=360)

PRE-PLATELET COUNT(/cumm)	No. of Donors	%age
<150	30	8.3
150-200	141	39.1
200-250	108	30
250-300	57	15.8
300-350	24	6.6

The platelet count in our donor population fall in lower range of normal platelet count i.e., 150-200/cumm and 200-250/cumm .

Table 4:- The distribution of platelet yield in the donor of study sample (n=360).

PLATLET YIELD ($\times 10^{11}$)	No. of donors	%age
<2	36	10
2-3	120	33.3
3-4	204	56.6

The platelet yield was between $2-3 \times 10^{11}$ in maximum number of donors.

Table 5:- The distribution of platelet yield in the donor of study sample (n=360)

Adverse effects	Number	%
Citrate reaction	12	3.3
Hematoma	6	1.6
Vasovagal reaction	2	.55
Hypovolemia	1	.27
Mech. Issue	3	.83

The side effects were less observed in the procedure done. The most common reaction had been citrate reaction followed by hematoma formation at vascular access site.

Table 6:- Correlation between various donor factors with Platelets yield.

Platelet Yield	Age	BMI	Hb	Hct	Pre-platelet count
	- 0.329 (<0.01)	+ 0.268 (<0.01)	0.063 (<0.01)	0.021 (<0.541)	0.284 (<0.01)

Discussion:-

Various studies have shown that transfusion of high platelet doses could reduce number of platelet concentrates required by thrombocytopenic patients even in patients with adverse clinical factors in which refractoriness to transfusion is common(17,18). Nevertheless, there are very few studies related to donor clinical and laboratory factors that may influence number of platelet yield (4,19). Identification of these factors would allow for better selection of donors resulting in higher platelet yield and consequently a lower number of donor exposures to the patients. Instruments which collect SDP are programmed to calculate the yield from the donor's haematocrit, platelet count, height and weight.

In our study, the mean pre-donation platelet count was $2.29 \pm 0.43 \times 10^5/\mu\text{L}$ and the mean platelet yield was $2.86 \pm 0.52 \times 10^{11}$. A direct linear correlation was obtained between the pre-donation platelet count and the platelet yield ($r = 0.284$, $p < 0.01$). Ravi et al (20), found the mean pre-donation platelet count was $2.69 \pm 0.65 \times 10^5/\mu\text{L}$ and the mean platelet yield was $3.16 \pm 0.62 \times 10^{11}$. A good direct linear correlation was obtained between the pre-donation platelet count and the platelet yield ($r = 0.284$, $p < 0.01$). Chaudary R et al, reported that out of 94 plateletpheresis procedures, the mean platelet yield was $3.65 \pm 0.80 \times 10^{11}$ when the pre-donation platelet count was $< 3 \times 10^5/\mu\text{L}$, while the mean yield was $2.5 \pm 0.59 \times 10^{11}$ when the pre-donation platelet count was $> 2 \times 10^5/\mu\text{L}$. They also observed a direct relationship between platelet count and platelet yield ($r = 0.50$, $p < 0.001$) (21). In a study, 2708 plateletpheresis procedures having a mean pre - donation platelet count of $2.37 \pm 49 \times 10^5/\mu\text{L}$ resulted in a platelet product with mean yield of $4.24 \pm 1.1 \times 10^{11}$. A direct linear correlation was observed with all the procedures (4). In a study (22) donor pre-donation platelet count was found to positively correlate with the platelet yield ($r = 0.51$, $p < 0.001$). A direct positive correlation was also observed in another study (17) ($r = 0.512$) (23). Our observations were similar.

In our study, 204 donors gave a platelet yield of more than 3×10^{11} per unit and thus 56.6% of our platelet yield met AABB guidelines. As per European guidelines 324 of our donors i.e., 93% had a platelet yield of $> 2 \times 10^{11}$ (20). Chaudhary et al., found only 41.5% of the SDPs met AABB guidelines (19).

Our study showed negative correlation between the donor age and platelet yield ($r = -0.329$, $p < 0.01$). Das SS et al., has showed a significant negative correlation between the donor age and platelet yield ($r = -0.229$, $p < 0.01$) but no such observation was reported in another study (21). The decreasing platelet yield with increasing age found in our study may be explained the physiological decrease that occurs to platelet count with increasing age (22).

We found a positive correlation between platelet yield and either haemoglobin ($r = 0.063$) or haematocrit ($r = 0.021$). While as positive correlation between platelet yield and donor haemoglobin and haematocrit have been found in some studies (25,17). No correlation was observed between the haemoglobin concentration and platelet yield in another study. They reported that donors with a haemoglobin levels of 16 g/dL or more gave a comparatively lower platelet yield. This could be related to the higher plasma volume processed in donors with low haemoglobin concentration thereby giving a higher platelet yield (19).

Furthermore, a positive correlation between BMI and platelet yield ($r = 0.268$, $p < 0.01$).

Similar observations were reported in another study (18) where BMI correlated consistently with a good platelet yield. But, in another study (19) where the quality of SDP in relation to low weight (40.8- 49.9 Kg) of the donors was studied, donor weight was not found to have any effect on platelet yield. Since there was only one female donor, we are not able to calculate the correlation between the platelet yield and gender. In a study (21) it was found that gender also influences platelet yield and women had higher yields. This was possibly because there is a higher prevalence of iron deficiency among women with consequent increase in platelet count; hormonal influence could also play a role.

Conflict of Interest : None .

References:-

- Whitaker BI. The 2011 National Blood Collection and Utilization Survey Report. Washington, DC: U.S. Department of Health and Human Services; 2013. Accessed at www.hhs.gov/ash/bloodsafety/2011-nbcus.pdf on 25 September 2014.
- Greeno E, McCullough J, Weisdorf D. Platelet utilization and the transfusion trigger: a prospective analysis. *Transfusion*. 2007;47: 201-5. [PMID: 17302764]
- Estcourt L, Stanworth S, Doree C, Hopewell S, Murphy MF, Tinmouth A, et al. Prophylactic platelet transfusion for prevention of bleeding in patients with haematological disorders after chemotherapy and stem cell transplantation. *Cochrane Database Syst Rev*. 2012;5:CD004269. [PMID: 22592695] doi:10.1002/14651858.CD004269.pub3
- Goodnough LT, Ali S, Despotis G, Dynis M, DiPersio JF. Economic impact of donor platelet count and platelet yield in apheresis products: relevance for emerging issues in platelet transfusion therapy. *VoxSang* 1999;76:43-9.
- Prince TH, editor. Standards for blood banks and transfusion services. 25th edition. Bethesda: MD: AABB, 2008.p.36.
- Council of Europe. Guide to the preparation, use and quality assurance of blood components. 12th edition. Strasbourg: Council of Europe Publishing; 2006.
- Fuller AK, Ugluk KM, Braine HG, King KE. A comprehensive program to minimize platelet outdating. *Transfusion*. 2011;51:1469-76. [PMID: 21303370] doi:10.1111/j.1537-2995.2010.03039.x
- Riley W, Smalley B, Pulkrabek S, Clay ME, McCullough J. Usin lean techniques to define the platelet (PLT) transfusion process and cost-effectiveness to evaluate PLT dose transfusion strategies. *Transfusion*. 2012;52:1957-67. [PMID: 22320153] doi:10.1111/j.1537-2995.2011.03539.x
- R Arun, A Yashovardhan, K Deepthi et al. Donor demographic and laboratory predictors of single donor platelet yield. *J Clin Sci Res* 2013;2:211-5.
- Mark E Bretcher (ed) Apheresis. Technical Manual American Association of blood banks 15 th edition AABB press 2005;139-158.
- Schrezenmeier H, Seifried E. Buffy-coat-derived pooled platelet concentrates and aphaeresis platelet concentrates: which product type should be preferred? *Vox Sang* 2010; 99: 1-15.
- Wiltbank TB, Giordano GF. The safety profile of automated collections: an analysis of more than 1 million collections. *Transfusion* 2007; 47: 1002-5.
- Despotis GJ, Goodnough LT, Dynis M, et al. Adverse events in platelet apheresis donors: a multivariate analysis in a hospitalbased program. *Vox Sang* 1999; 77: 24-32.
- Rima Kusumgar, Shailee Mehta, Manoj Shah, Mr. Rajesh Rajvanshi. A Two Years Study of deferral among platelet pheresis donors in a cancer care Institute. *Pathol and lab medicine* 2014;6(1):37-39.
- R Tondon, P Pandey, R Chaudhry. A 3-year analysis of plateletpheresis donor deferral pattern in a tertiary health care institute: assessing the current donor selection criteria in Indian scenario. *J Clin Apher* 2008; 23:123-28. <http://dx.doi.org/10.1002/jca.20171>
- P Pandey, AK Tiwari, J Sharma, MB Singh, S Dixit, V Raina. A prospective quality evaluation of single donor platelets (SDP) - an experience of a tertiary healthcare center in India. *Transfus Apher Sci* 2012;46:1163-6
- Norol F, Bierling P, Roudot-Thorval F, Ferrer Le Coeur F, Rieux C, Lavaux A, et al. Platelet transfusion: a dose-response study. *Blood* 1998;92:1448-53.
- Kelley DL, Fegan RL, Ng AT, Kennedy MK, Blanda E, Chambers LA, et al. High-yield platelet concentrates attainable by continuous quality improvement reduces platelet transfusion cost and donor exposure. *Transfusion* 1997;37:482-6.
- Chaudhary R, Das SS, Khetan D, Sinha P. Effect of donor variables on yield in single donor plateletpheresis by continuous flow cell separator. *Transfus Apher Sci* 2006;34:157-61.
- Arun R, Yashovardhan A, Deepthi K, Suresh B, Sreedhar Babu KV, Jothibai DS. Donor demographic and laboratory predictors of single donor platelet yield. *J Clin Sci Res* 2013;2:211-5.
- Lasky LC, Lin A, Kahn RA, McCullough J. Donor platelet response and product quality assurance in plateletpheresis. *Transfusion* 1981;21:247-60.
- Das SS, Chaudhary RK, Shukla JS. Factors influencing yield of plateletpheresis using intermittent flow cell separator. *Clin Lab Haematol* 2005;27:316-9.
- Enein AA, Hussein EA, El Shafie S, Hallouda M. Factors affecting platelet yield and their impact on the platelet increment of patients receiving single donor PLT transfusion. *J Clin Apher* 2007;22:5-9.
- Blino G , Santimoro I, Minelli C, Sorice R, Frongia B, et al Age and Sex related variations in platelet count in Italy: a proposal of reference ranges based on 40987 subjects data. *PLoS One* 2013;8(1):e 54289.
- Guerrero-Rivera S, Gutiérrez-Espindola G, Talavera JO, Meillón-García LA, Pedraza-Echevarria M, Pizzuto-Chávez J. Hemoglobin and platelet count effect on platelet yields in plateletpheresis. *Arch Med Res*. 2003;34:120-3.
- Badami KG, Sesun M, Basu A, Absalom N. Demographic, laboratory, and operational variables that influence short-and long-term plateletpheresis yields. *J Clin Apher* 2012;27:247-54.