

# FACTORS INFLUENCING YIELD OF PLATELET APHAERESIS USING CONTINUOUS FLOW CELL SEPARATOR

Jitendra Patel<sup>1</sup>, Arpita Nishal<sup>2</sup>, Amrish Pandya<sup>1</sup>, Prashant Patel<sup>2</sup>, Sangita Wadhvani<sup>1</sup>

<sup>1</sup> Department of Immunohematology & Blood Transfusion, Government Medical College, Surat, Gujarat, India

<sup>2</sup> Department of Pathology, Government Medical College, Surat, Gujarat, India

Correspondence to: Jitendra Patel (onlyg2@gmail.com)

DOI: 10.5455/ijmsph.2013.2.323-326 Received Date: 23.01.2013

Accepted Date: 29.01.2013

## ABSTRACT

**Background:** In Transfusion Medicine, screening for suitable donor for platelet aphaeresis is difficult and time consuming procedure. This might lead to delayed supply of life saving Single Donor Platelet to critically bleeding patient.

**Aims & Objective:** The aim of this study was to analyse the effect of various donor and procedure related parameters on the yield of single donor platelet so that the transfusionist as well as clinician can screen blood donors effectively in less time. Pre-donation platelet count, haemoglobin, haematocrit & weight were included as donor related variables. Processing time and blood volume processed were assessed as procedure related variables.

**Material and Methods:** A total number of 265 platelet aphaeresis procedures were performed on CS 3000 plus with AMS cell separator (Fenwal, USA) using closed & open system aphaeresis kits & studied with respect to donor's, procedure's & patient's related data. The statistical analysis used in this study was Pearson Correlation ('r' value).

**Results:** The mean pre-donation platelet count was  $286 \pm 55 \times 10^3/\text{cu mm}$  & mean platelet yield of all procedures was  $3.3 \pm 0.68 \times 10^{11}$ .

**Conclusion:** Platelet yield correlated positively with pre-donation platelet count ( $r = 0.302$ ,  $P < 0.0001$ ). Donor's weight, haemoglobin & haematocrit were not correlated with the yield & did not affect the yield of single donor platelets.

**KEY-WORDS:** Cell Separator; Haemoglobin; Platelet Count; Plateletpheresis; Single Donor Platelet; Weight

## Introduction

There has been a trend towards the use of single donor platelet (SDP) rather than pooled random donor platelet (RDP) in patient with thrombocytopenia over the last decade.<sup>[1]</sup> This trend has been resulted from the observations that SDP is a better platelet product due to less number of donor exposures and consequent reduction in transfusion transmitted diseases, transfusion reactions and possibly allo-immunization.<sup>[2-4]</sup> Currently, more than 50% of platelets are produced by plateletpheresis in developed countries.<sup>[1]</sup> In India, because of economic constraints & limited resources, SDP is not in that much demand till date.

Platelet recovery in the patient is influenced by the transfused dose of platelets, which in turn is dependent on the quality of SDP in terms of platelet yield.<sup>[5]</sup> Donor platelet count has a direct impact on the yield of platelets.<sup>[2]</sup> Buchholz et al

observed that large numbers of voluntary blood donors are deferred due to low weight or low platelet count.<sup>[6]</sup> At present blood bank also a large number of donors willing to donate SDP are deferred due to low platelet count ( $< 150 \times 10^3/\text{cu mm}$ ) or low haemoglobin concentration. If donors with suboptimum platelet count ( $< 200 \times 10^3/\text{cu mm}$ ) are deferred, a large number of potential plateletpheresis donors will be excluded from the donor pool & delay will occur in platelet transfusion in critically bleeding patient.

In present study, the influences of donor's pre-donation platelet count (PC) and haemoglobin concentration (Hb) on the yield of SDP were studied to overcome the problem of scarcity of aphaeresis donors. The influences of donor's pre-donation haematocrit value (Hct) & weight along with few procedure related parameters like procedure duration & volume processed were also looked for the same. The aim of present study was to help clinicians & blood bank personnel in

selecting appropriate donor for plateletpheresis as early as possible to serve bleeding patient and to save his or her life.

## Materials and Methods

This study was done during time period of August 2006 to June 2012 at Blood Bank, Central Clinical Laboratory & various clinical departments of government tertiary level hospital after obtaining the ethical committee clearance from the same institute. During this period total number of 265 platelet aphaeresis procedures were done on CS 3000 plus with AMS cell separator (Fenwal, USA) using closed & open system aphaeresis kits & studied with respect to donor's, procedure's & patient's related parameters. Out of these 265 procedures, data of 230 procedures were evaluated for the present study. During this period, all donors were met the donor eligibility criteria as laid down by the Food & Drug Administration Act, India.

The plateletpheresis procedures were performed following standard operating procedure using ACD as an anticoagulant in the proportion of 1: 10. The end point of the procedure was predefined blood volume of donor to be processed for aphaeresis procedure which varied from 3000-4000 ml. Approximately 1 to 2 ml sample from each bag was collected in the satellite pouch attached to bag to ensure representative product of the bag. These samples were used to calculate yield of SDP. Samples were mixed thoroughly and subjected to determination of platelet count after appropriate dilution (if required) on an automated analyser to calculate the yield. The samples were analysed for various haematological parameters such as platelet count and haemoglobin on an automated analyser (Sysmex KX-21).

## Statistical Analysis

Influences of donor & procedure related variables on the yield of SDP were studied by calculating 'r value' (Pearson Correlation) at 95 % confidence interval using MS Excel Software (MS Office 2010). The P values were derived using online calculator of web site (<http://vassarstats.net/index.html>).

## Results

A total of 230 healthy donors with mean body weight of  $67.60 \pm 10.5$  kg underwent plateletpheresis on continuous flow cell separator (CS 3000 plus with AMS cell separator of Fenwal, USA). The mean blood volume processed was  $3225 \pm 555$  ml over the mean duration of  $75 \pm 19$  min. The mean pre-donation platelet count was  $286 \pm 55 \times 10^3/\text{cu mm}$  & the mean platelet yield of all procedures was  $3.33 \pm 0.68 \times 10^{11}$ .

A direct positive linear correlation was observed between donor's pre-donation PC & yield of SDP. The Pearson value r was 0.302 with  $P < 0.0001$ . Such correlations were not observed for donor's pre-donation Hb, Hct, weight & procedure time (r value were -0.001, -0.018, 0.023 & -0.047 respectively). The r value for correlation between donor volume processed for aphaeresis & yield of SDP was 0.158 ( $P$  value  $< 0.05$ ).

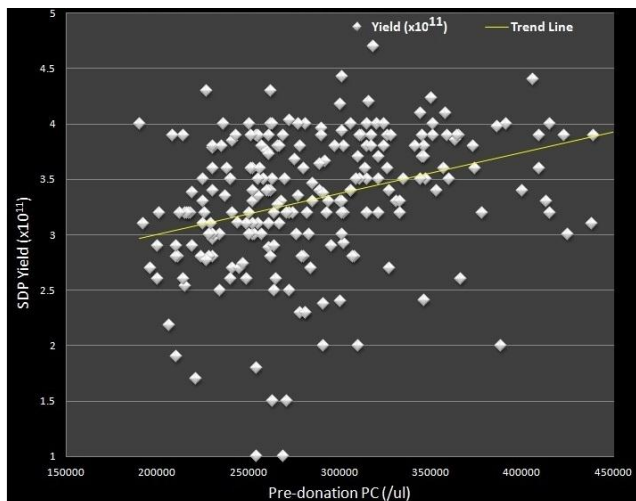
## Discussion

Platelet recovery in the patient is influenced by the transfused dose of platelets, which in turn is dependent on the quality of SDP in terms of platelet yield. The aim of this study was to analyse the impact of various donor and procedure related parameters on platelet yield in 265 platelet aphaeresis procedures, to optimize platelet yield achieving clinical and economic advantages. 230 aphaeresis procedures were analysed. Weight, haemoglobin, haematocrit and pre-procedure platelet counts were included as donor related variables. Volume processed, processing time, inlet line blood flow, vein puncture status and other trouble shootings of procedure were assessed as Procedure related parameters.

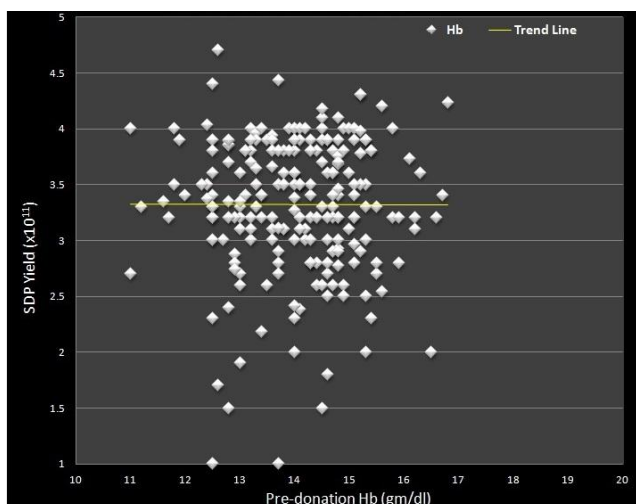
According to the S S Das et al, Goodnough et al, Guerrero-Rivera et al, A Aboul Enein et al & Rajendra Chaudhary et al platelet yield is predominantly dependent on the donor platelet count.<sup>[2,5,7-9]</sup> Goodnough et al studied 708 plateletpheresis procedures performed on 533 donors having mean pre-donation platelet count of  $237 \pm 49 \times 10^3/\text{cu mm}$  which resulted in platelet product with mean yield of  $4.24 \pm 1.1 \times 10^{11}$ .

**Table-1: Pearson Values for Correlation of Donor & Procedure Related Factors with Yield of SDP in Different Studies**

Pearson Correlation (r value) with-	Goodnough et al	Rajendra Chaudhary et al	S S Das et al	Guerrero-Rivera S et al - Group A	Guerrero-Rivera S et al - Group B	A Aboul Enein & E A Hussein et al	Present Study
Pre-donation PC	Direct correlation	0.506 (< 0.001)	0.51 (< 0.001)	0.554	0.758	0.512	0.302 (< 0.0001)
Pre-donation Hb	-	-0.1 (> 0.005)	-0.05 (> 0.005)	Inverse correlation	Inverse correlation	-0.306	-0.001 (> 0.05)
Pre-donation Hct	-	-	-	-	-	-	-0.018 (> 0.05)
Donor's weight	-	0.18	-	-	-	-	0.023 (> 0.05)
Procedure time	-	-	-	-	-	-	-0.047 (> 0.05)
Total volume processed	-	-	-	-	-	-	0.158 (< 0.05)



**Figure-1: Pre-donation PC vs SDP Yield**



**Figure-2: Pre-donation Hb vs SDP Yield**

A direct linear correlation was observed with all the procedures.<sup>[2]</sup> S S Das et al studied 61 plateletpheresis procedures. Pearson correlation of 61 procedures indicated good direct linear correlation between pre-donation platelet count and yield for all procedures ( $r = 0.51, P < 0.001$ ).<sup>[7]</sup> Guerrero-Rivera et al observed that donor's pre-donation platelet count had an influence on the platelet yield in the form of positive correlation ( $r = 0.554$  in group A,  $r = 0.758$  in group B).<sup>[5]</sup> A

Aboul Enein et al also found that yield correlated positively with platelet pre-count ( $r = 0.512$ ).<sup>[8]</sup> A direct relationship was observed between pre-donation platelet count and yield ( $r = 0.50, P < 0.001$ ) by Rajendra Chaudhary et al.<sup>[9]</sup> Results of present study were also in agreement with these observations. There was a direct positive correlation between the platelet yield and pre-donation platelet count ( $r = 0.302, P < 0.0001$ , Table 1, Figure 1).

Another donor factor that may have an influence on the platelet yield is pre-donation haemoglobin concentration, which has an inverse relationship with the yield in study done by Guerrero-Rivera et al.<sup>[5]</sup> While S S Das et al & Rajendra Chaudhary et al had observed no correlation of pre-donation haemoglobin concentration of the donor with yield ( $r = -0.05$  &  $r = -0.1$  respectively,  $P > 0.005$ ).<sup>[7,9]</sup> A Aboul Enein et al found that yield negatively correlated with donor pre-apheresis haemoglobin ( $r = -0.306$ ).<sup>[8]</sup> No such correlation was observed in the present study ( $r = -0.001, P > 0.005$ , Table 1, Figure 2).

No correlation was observed in the present study ( $r = -0.018, P > 0.005$ , Table 1) between donor's pre donation haematocrit & platelet yield. This study also did not show correlation between donor's weight & yield ( $r = 0.023, P > 0.005$ ). This finding is consistent with study done by R Chaudhary et al ( $r = 0.18$ ).<sup>[9]</sup>

According to A Aboul Enein et al, another factor that correlated positively was total volume processed ( $r = 0.404$ ), however increasing the processing time, the ACD infusion rate, or the volume of plasma obtained with platelet can

increase platelet yields.<sup>[8]</sup> The present study had also shown a correlation between donor's total volume processed & yield ( $r = 0.158$ ,  $P < 0.05$ ).

## Conclusion

There are multiple factors affecting the yield of SDP. Pre-donation platelet count of the donor is the main donor related factor affecting yield of SDP. A pre-donation platelet count is directly related with the yield of SDP. Other factors affecting are volume processed, processing time, inlet line blood flow, interface offset, vein puncture status and other trouble shootings of procedure. Donor's weight, haemoglobin & haematocrit are not affecting yield of SDP.

## References

- Wallace EL, Churchill WH, Surgenor DM, Cho GS, McGurk S. Collection and transfusion of blood and blood components in the United States, 1994. *Transfusion*. 1998;38(7):625-36.
- Goodnough LT, Ali S, Despotis G, Dynis M, DiPersio JF. Economic impact of donor platelet count and platelet yield in aphaeresis products: relevance for emerging issues in platelet transfusion therapy. *Vox Sang*. 1999;76(1):43-9.
- Chambers LA, Kruskall MS, Pacini DG, Donovan LM. Febrile reactions after platelet transfusion: the effect of single versus multiple donors. *Transfusion*. 1990;30(3):219-21.
- Gmür J, von Felten A, Osterwalder B, Honegger H, Hörmann A, Sauter C et al. Delayed alloimmunization using random single donor platelet transfusions: a prospective study in thrombocytopenic patients with acute leukemia. *Blood*. 1983;62(2):473-9.
- Guerrero-Rivera S, Gutiérrez-Espíndola G, Talavera JO, Meillón-García LA, Pedraza-Echevarría M, Pizzuto-Chávez J. Hemoglobin and platelet count effect on platelet yields in plateletpheresis. *Arch Med Res*. 2003;34(2):120-3.
- Buchholz DH, Squires JE, Herman JH, Ng AT, Anderson JK, Hedberg SL. Plateletpheresis in 90- to 110-pound donors using the CS-3000 blood cell separator. *Transfusion*. 1997;37(7):715-8.
- DAS SS, Chaudhary RK, Shukla JS. Factors influencing yield of plateletpheresis using intermittent flow cell separator. *Clin Lab Haematol*. 2005;27(5):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(1):5-9.
- 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(2):157-61.

**Cite this article as:** Patel J, Nishal A, Pandya A, Patel P, Wadhvani S. Factors influencing yield of platelet aphaeresis using continuous flow cell separator. *Int J Med Sci Public Health* 2013; 2:309-312.

**Source of Support:** Nil

**Conflict of interest:** None declared