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COMPARISON OF POST – TRANSFUSION EFFECTS OF PLATELET CONCENTRATES – WHOLE BLOOD DERIVED RANDOM DONOR PLATELETS (RDPs) AND APHERESIS DERIVED SINGLE DONOR PLATELETS (SDPs), IN THROMBOCYTOPENIC PATIENTS

Transfusion Medicine

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ABSTRACT

Platelets are essential for the formation of the primary hemostatic plug and maintenance of normal hemostasis. There are two types of platelet concentrates available, namely RDPs and SDPs. Judicious and Rational use of these concentrates in the management of cases with thrombocytopenia is crucial. **Objective:** The present study was conducted to compare the post transfusional effects of RDPs and SDPs in thrombocytopenic patients at tertiary care centre of southern Rajasthan. **Method:** This prospective, time bound study was conducted among 72 patients having different diseases with thrombocytopenia, who required therapeutic platelet concentrate transfusion (SDP or RDP). Each day patients who were issued platelet concentrate/s were identified from the requisition forms received at the blood bank. The demographic details including name, age, gender and weight of patient, blood group, unique hospital identification number, department of admission, provisional clinical diagnosis and indication for transfusion, type of platelet concentrate issued were noted. Proper history from patients regarding previous transfusion , previous ailments were also noted. Blood samples were taken from these patients and sent to lab for CBC report. Platelet increments, Corrected Count Increment(CCI) and PPR (Percentage Platelet Recovery) were assessed. **Results:** The result of this study showed that 72.22 % of the patients had successful platelet transfusion with the CCI and PPR values above the standard values. But 27.78% patients had an unsuccessful platelet transfusion owing to various clinical factors such as male gender, ABO incompatible platelet transfusion, Sepsis , Fever. Patients who received RDP showed mean CCI-1hr of 10,256, CCI-24 hr of 6216, PPR-1hr of 32.86% and PPR-24hr of 21.12%. Patients who received SDP showed mean CCI-1hr of 16308, CCI-24hr of 11868, PPR-1hr of 51.92%, PPR- 24hr of 38%. The mean increment in platelet levels at 1 and 24 hrs were 35848 and 21272, respectively. **Conclusion:** SDPs should be preferred platelet concentrate in patients requiring chronic platelet transfusions or those requiring more than 4 RDPs. ABO compatible RDPs should be transfused to get the desired post transfusion platelet increments.

KEYWORDS

SDPs – Single Donor Platelets, RDPs – Random Donor Platelets, CCI – Corrected Count Increment, PPR – Percentage Platelet Recovery, TRALI – Transfusion Related Acute Lung Injury, TTI – Transfusion Transmitted Infections

INTRODUCTION

Platelets are essential for the formation of the primary haemostatic plug and maintenance of normal haemostasis. Platelets, also called thrombocytes, are a component of blood, whose function (along with the coagulation factors) is to react to bleeding from blood vessel injury by clumping, thereby initiating a blood clot.

Platelet transfusions are indicated for patients who are bleeding because of thrombocytopenia or abnormally functioning platelets. In a tropical country like India, infectious causes such as Dengue predominate. Other causes include autoimmunity, malignancy, DIC, hypersplenism etc.

Platelets form the haemostatic plug and provide the surface on which fibrin forms in a bleeding patient resulting in cessation of bleeding, correction of prolonged bleeding time and rise in platelet count.

Two types of platelet concentrates are available for transfusion namely RDPs (Random Donor Platelets) and SDPs (Single Donor Platelets).

This study compares the post transfusional effects of these platelet concentrates in thrombocytopenic patients to assess –
1. Which method of platelet preparation is better in terms of post transfusion recovery in patients.
2. Post transfusion platelet count increment using Corrected Count Increment (CCI) and Percentage Platelet Recovery (PPR)
3. Effectiveness of platelet concentrates based on diagnosis

MATERIALS AND METHODS

• This prospective, time bound study was conducted among 72 patients having different diseases with thrombocytopenia, who required therapeutic platelet concentrate transfusion (SDP or RDP).
• RDP was prepared using fresh whole blood – PRP Method (principle - centrifugation) using the machine HERAEUS CRYOFUGE 6000i CENTRIFUGE.
• SDP was prepared from live donors using the aphaeresis machine – COM.TEC Fresenius KABI.
•Each day patients who were issued platelet concentrate/s were identified from the requisition forms received at the blood bank.
• The demographic details including name, age, gender and weight of patient, blood group, unique hospital identification number, department of admission, provisional clinical diagnosis and indication for transfusion, type of platelet concentrate issued were noted. Proper history from patients regarding previous transfusion, previous ailments were also noted.
• 2-3 ml of sample from patients were collected in their respective wards, aseptically in EDTA vial at three different time intervals:
1. Before Transfusion
2. After Transfusion – 1hr
3. After Transfusion – 24 hrs

These samples were then sent to the Central Lab, RNT Medical College, Udaipur for their Complete Blood Count (CBC) report. Platelet counting was done by automated cell counter – ADONIS – Axiom – 19 Plus New.

Platelet Count from each report i.e., pre – transfusion, after transfusion – 1hr and after transfusion – 24hr, was noted down. The main outcomes were measured by the following methods :
1. CCI – Corrected Count Increment
2. PPR – Percentage Platelet Recovery

Corrected count increment and Percentage platelet recovery are measures of response to platelet transfusion that “correct” the count increment for blood volume and number of platelets transfused.

CCI (Corrected Count Increment)
(Platelet increment/µl) x (Body surface area in m2) × 10^11/ Number of platelets transfused = Platelets/µl/m 2

PPR (Percentage Platelet Recovery)
[(Platelet increment/µl) x (weight in kg x 75 ml)] x 100/ Platelet count of product/µl x Volume of platelet in ml = Platelet count %

Platelet increment = Post transfusion platelet count- Pretransfusion platelet count

Platelet Count for each bag was noted from the Complete Blood Count of the donor. Estimation of body surface area = √Height (cm)×Weight (kg)/60. A mean value of 1.6m^2 (height – 155cm and weight – 50kg) was taken as standard for all the patients. All the data was then collected and put together in formulas for CCI and PPR and the outcomes were noted. A Platelet Increment of >10 × 10 9 /l at 1 or 24 h was considered a successful transfusion. A value less than that indicated refractoriness. A Percentage platelet recovery of >30% at 1 hr and >20% at 20–24 hr post transfusion was considered to be a successful one. A Corrected Count Increment of >10 × 10 9 /l at 1 h and >5 × 10 9 /l at 20–24 h was considered to be a successful transfusion. A CCI value below 5 x 10^9 /l was considered to be refractory.

Indications For Platelet Transfusion

1. Thrombocytopenia with bleeding or invasive procedure.
2. Chemotherapy for malignancy (decreased production, less than 5,000 to 10,000/µl)
3. Disseminated intravascular coagulation (increased destruction, less than 50,000/µl)
4. Massive transfusion (platelet dilution, less than 50,000 to 100,000/µl)

Inclusion Criteria

- Patients with thrombocytopenia who required platelet concentrate infusion

Exclusion Criteria

- Patients with heparin Induced Thrombocytopenia, TTP (Thrombotic Thrombocytopenic Purpura), PTP (Post Transfusion Purpura).
- Repeat Platelet transfusion patients were not included.
- Patients who could not be followed up or those who didn't give consent.
- Patients admitted in hospitals other than Maharana Bhupal Hospital, Udaipur

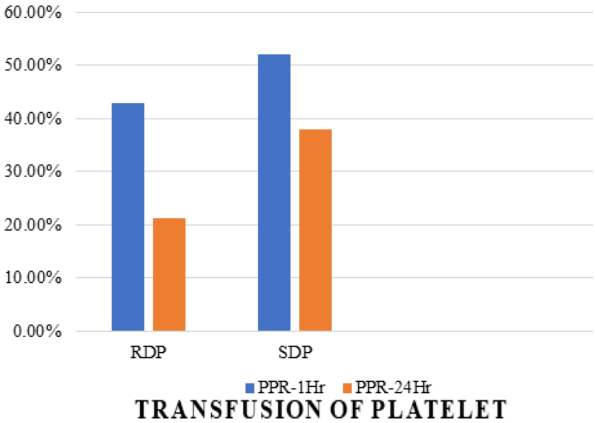
RESULT

1. It was observed that Cases with Massive Splenomegaly, high fever, sepsis, disseminated intravascular coagulation (DIC) and platelet or HLA antibodies caused less than expected platelet count and survival. The analysis showed that the CCI and PPR showed a less rise in certain clinical factors like Male, Bleeding, Fever, Sepsis, ABO – unmatched platelets as compared to Female, non – bleeding, No fever, No sepsis and ABO – matched platelets.
2. those patients who received SDP as the platelet concentrate showed a higher CCI and PPR as compared to those patients who received RDP as the platelet concentrate.
3. The study identified a high rate of inadequate platelet transfusions.
4. Implementation of educational programmes for the clinicians on proper use of platelet concentrates according to standard guidelines are recommended based on the findings of this study.
5. SDPs should be preferred platelet concentrate in patients requiring chronic platelet transfusions or those requiring more than 4 RDPs.
6. ABO compatible RDPs should be transfused to get the desired post transfusion platelet increments.
7. Among the patients who received RDP (ABO compatible) showed a higher mean CCI and PPR as compared to those who received RDP (ABO incompatible).

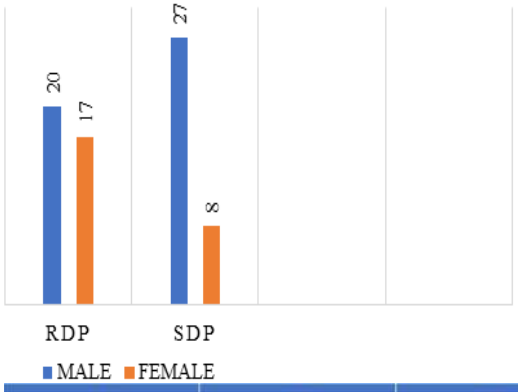
Influence of Clinical Factors in Platelet Transfusions as Assessed by CCI and PPR Equations at 24 Hours Posttransfusion in 72 Platelet Transfusions

Clinical Factor	No.	CCI	P Value	PPR (%)	P Value
Male	47	10,258	0.021	25.7	0.015
Female	25	14,317		30.8	
Bleeding	44	7,212	0.042	26.7	0.011
No Bleeding	28	12,858		30.5	
Fever	53	9,555	0.012	22.5	0.024
No Fever	19	12,432		31.2	
Sepsis	22	3,668	0.013	17.6	0.036
No Sepsis	50	13,490		34.7	
Splenomegaly	12	6,868	0.043	21.1	0.022
No Splenomegaly	60	11,222		22.6	
Hypotension	45	7,612	0.707	27.8	0.334
No Hypotension	27	11,510		29.8	
Patients who received ABO – matched Platelets	42	14,789	0.005	37.3	0.044
Patients who received ABO – unmatched Platelets	30	9,260		22.4	

Percentage Platelet Recovery Assessed At 1 and 24 Hrs

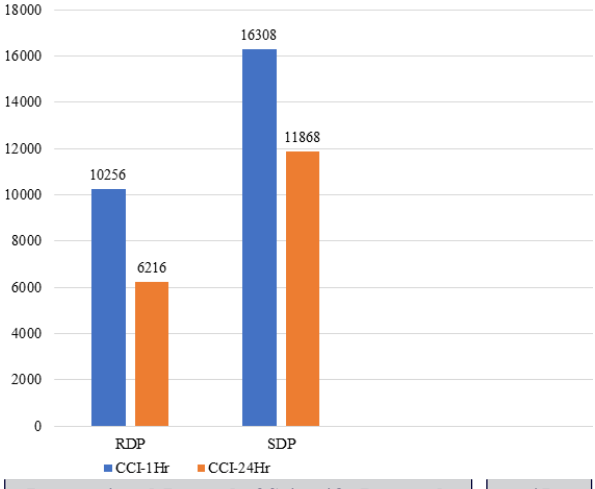


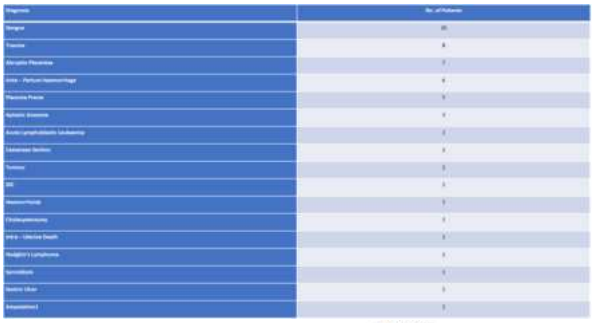
TRANSFUSION OF PLATELET CONCENTRATES IN MALES AND FEMALES

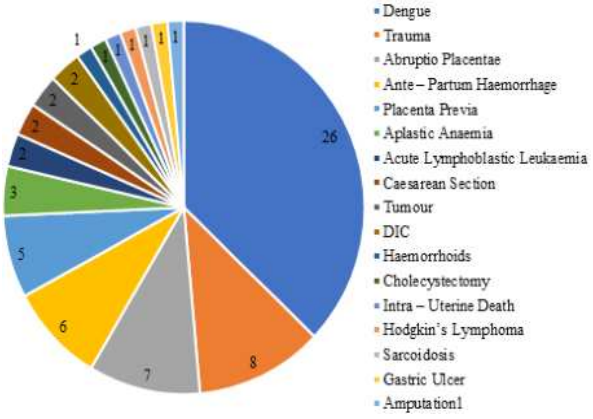


SEX	RDP	SDP
MALE	20	27
FEMALE	17	8

Corrected Count Increment Assessed at 1 and 24 Hrs







DISCUSSION

This study provides a detailed comparison of two widely used platelet concentrates: SDP and RDP, comparing them on the basis of clinical condition of patient requiring them, the platelet increment and effectiveness. In our study, taking guidelines from "American Association of Blood Banking" as reference standard, 52 (72.22%) patients out of a total of 72 patients showed a a satisfactory platelet transfusion. Among these 52 patients 31 received SDP and 21 patients received RDP. Out of the 21 patients who received RDP 19 patients received ABO – compatible RDPs. But 27.78% patients had an unsuccessful platelet transfusion owing to various clinical factors such as male gender, ABO incompatible platelet transfusion, Sepsis, Fever. The most inappropriate use of platelet concentrates was done by the Obstetrics Department.

Many authors have conducted study on this comparison . Some of them are:

1. In a study conducted by J M Heal et al (1993) on the role of ABO matching in platelet transfusion. He concluded that patients requiring long-term platelet support should be transfused with ABO-identical platelets.
2. Heal JM et al (1986) conducted a study on Bacterial proliferation in platelet concentrates. He concluded that bacterial contamination of platelets was not clinically significant at 3 days of storage but it might become so during the current 7-day shelf life.
3. In a similar study conducted by EJ Lee et al (1989) on 60 consecutive patients with untreated acute leukaemia who alternatively received either ABO-matched or ABO-mismatched random-donorplatelet transfusions prepared from pooled platelet concentrate stored for 1 to 3 days. The study concluded that ABO compatibility can affect the results of random-donor platelet transfusions and that patients who experience poor increments from ABO-mismatched platelets may benefit from a trial of ABO-compatible platelets before the initiation of HLA- matched platelet transfusion.

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