

# Platelet audit: Assessment and utilization of this precious resource from a tertiary care hospital

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## Abstract

**Background:** To assess the appropriate utilization of platelet transfusions [random donor platelets (RDP) and single donor platelets (SDP)]; a six-month retrospective audit was carried out in a tertiary care hospital. **Materials and Methods:** A six-month retrospective platelet audit was carried out from May to October 2005 to estimate its preparation, appropriate utilization and wastage rate. Patient's demographics, transfusion triggers and episodes and ABO and Rh (D) group specific or non-group specific transfusions were also assessed. **Results:** About 5525 units of platelets [PRP-PC, 3,813 (69%); BC-PC, 983 (17.8%); PRP, 648 (11.7%) and SDP 81 (1.5%)] were prepared and transfused to 853 patients (RDP to 814 patients and SDP to 39 patients) in 2,093 transfusion episodes. Adult and pediatric hemato-oncology were the main user specialties utilizing 39.1 and 87.6% of the RDPs and SDPs prepared. Of the patients receiving RDPs, 95% were transfused ABO and Rh (D) group specific platelets whereas 100% SDPs transfusions were of group specific platelets. 88% of prophylactic platelet transfusions were appropriate as per the recommended BCSH guidelines. However, 12% of the prophylactic platelets were transfused inappropriately in cardiopulmonary bypass (CPB) surgeries with normal platelet counts and no evidence of bleeding related to platelets. Out of 5,444 RDPs prepared 1,585 (29.11%) units were not utilized. **Conclusions:** Regular audit of blood and blood components is a must so that necessary remedial measures can be taken to maximize appropriate and judicious utilization of each component.

## Key words:

Appropriate utilization, platelet transfusion, transfusion audit

Transfusion of components derived from human blood underpins modern medicine. Blood component therapy has benefited many patients by meeting their specific transfusion needs from a single blood donation. However, despite having various guidelines for platelet transfusion therapy both internationally<sup>[1-4]</sup> and nationally,<sup>[5]</sup> noncompliance to these are frequently seen. This inappropriate use occurs as the level of awareness among clinicians varies significantly. Unnecessary allogeneic component exposure poses threat to transfusion transmitted infections (TTI), alloimmunization and platelet refractoriness. Also ignorance regarding platelet handling, storage, transfusions across ABO and Rh (D) barrier and transfusion triggers has led to wastage of this perishable blood component.

Transfusion audits are important tools to reduce inappropriate transfusions in patients, while continuously improving practice guidelines, encouraging consultation with prescribers and identifying areas of further improvement. We conducted a retrospective platelet audit to assess its preparation, appropriate utilization, and wastage at our Institute.

## Materials and Methods

### Definition of terms and calculations:

1. Random donor platelet (RDP): A platelet unit that is prepared from a single blood unit (350 ml/450 ml). It can be either in form of platelet-rich plasma-platelet concentrate (PRP-PC), buffy coat-reduced platelet concentrate (BC-PC) or platelet-rich plasma (PRP).
2. Single donor apheresis platelet (SDP): A platelet unit that is prepared from a single donor with the aid of automated cell separator having a platelet dose equivalent to 4-6 RDPs.
3. Transfusion episode: Each transfusion event in which a patient was transfused 1-5 RDP units simultaneously or a SDP.
4. Expired unit: A platelet unit that was discarded because its maximum allowable storage time was reached (synonym: outdated unit)
5. Wasted unit: A platelet unit that was discarded prior to its expiration date due to undesired change in physical appearance (gross red blood cells contamination, lipaemia, clot or gas formation), bag rupture or leakage during component preparation, loss of swirling or

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mishandling during storage (deviation from prescribed temperature range).

6. Reactive unit: A platelet unit that was discarded after being found to be reactive for either anti HIV I/II, anti HCV, HBsAg, VDRL or malaria.
7. Expiration rate: The expiration rate was calculated as follows.  

$$\frac{\text{No. of expired units of platelets} \times 100}{\text{No. of units of platelet concentrates prepared}}$$
8. Wastage rate: The wastage rate was calculated as follows.  

$$\frac{\text{No. of wasted units of platelets} \times 100}{\text{No. of units of platelet concentrates prepared}}$$

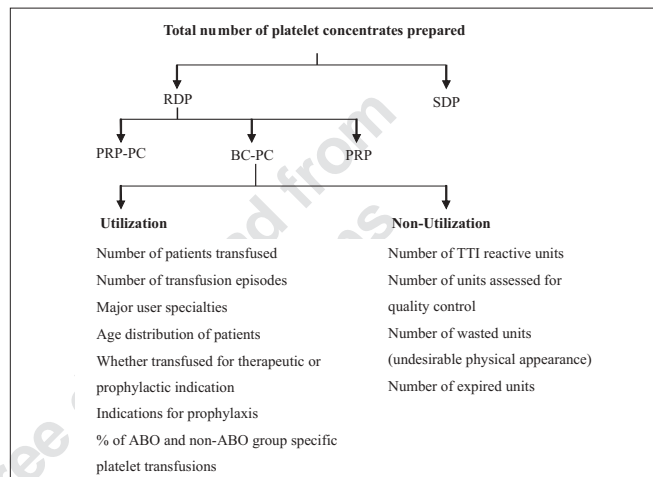
A 6-month retrospective platelet audit was carried out from May to October 2005 in the Department of Transfusion Medicine, at the Institute, which is a tertiary care 1400-bedded hospital running various specialties and super-specialties. Annually, we prepare around 62,000 blood/blood components, receive 48,000 blood/blood component requisitions and issue 55,000 blood/blood components to cater to our patient's needs.

Before conducting the audit, a resident manual on 'Guidelines for blood and blood components: Preparation, storage and its administration' was released in September 2004 for educating all clinicians and nursing staff of the Institute. The manual is also issued to all new resident doctors enrolling for various specialties and super-specialties in the Institute. We follow platelet transfusion guidelines laid down by the British Committee for Standards in Haematology (BCSH)<sup>[1]</sup> [Table 1]. As per the standards, the department is following the policy of transfusing ABO and Rh (D) group-specific platelet transfusions and recommending Rh IgG immunoprophylaxis in Rh (D) negative woman of child-bearing potential where Rh (D) positive platelet transfusions were warranted.<sup>[1]</sup> At our centre, platelet transfusion policy for selection of ABO group-specific platelets is shown in Table 2.

The audit was planned as shown in Figure 1. The data for monthly platelet preparation (PRP-PC, BC-PC, PRP and SDP) was obtained from departmental records. Random donor platelets were stored for a maximum period of 3 days and SDP for 5 days (as per storage bags available) at 22±2°C with continuous horizontal, gentle agitation (70±5 oscillations/min) in a platelet incubator-cum-agitator. Patient's information regarding their

**Table 2: Suggested ABO selection order for transfusion of random donor platelet concentrates**

Recipient ABO group	Component ABO group			
	Option 1	Option 2	Option 3	Option 4
O	O	B	A	AB
A	A	AB	O	B
B	B	AB	O	A
AB	AB	B	A	O



**Figure 1: Platelet audit plan**

age, gender, specialty, platelet counts, transfusion episodes, therapeutic or prophylactic transfusion and ABO and Rh (D) group specific or non-group specific was obtained from requisition forms and platelet issue record registers. The data regarding platelet wastage (undesirable physical appearance, leaks or bag rupture, TTI reactive) and expiry was analyzed from departmental records to calculate expiry rate and wastage rate. One percent of the platelets prepared/month or 10 units/month, whichever was more, was taken for quality control parameters. Appropriateness of platelet transfusions was assessed according to guidelines shown in Table 1 and utilization pattern for various specialties and super-specialties was noted.

## Results

During 6-month study period, 5,525 units of platelets [PRP-PC, 3,813 (69%); BC-PC, 983 (17.8%); PRP, 648 (11.7%) and SDP 81 (1.5%)] were prepared. These units were transfused to 853 patients (RDP to 814 patients and SDP to 39 patients) in 2,093 transfusion episodes. Out of 853 patients, 68 were transfused with both RDP and SDP during their hospital stay. The patient demographics (age, gender, and indications) and utilization pattern of RDP and SDP according to various clinical specialties and super-specialties is shown in Table 3. The mean ABO group specific RDP usage/patient (range) was 4.94 (1-42) unit(s) and average RDP transfusion/episode (range) was 1.91 (1-5) unit(s). 73.8% of the RDPs were utilized for therapeutic indications whereas SDPs were transfused for prophylactic indications in 77.8% of cases. Adult and pediatric hemato-oncology were the main user specialties utilizing 39.1 and 87.6% of the RDPs and SDPs prepared. In patients receiving RDPs, 742 (91.1%) were transfused ABO and Rh (D) group specific platelets whereas 100%

**Table 1: Indications for platelet transfusions**

### Prophylactic

1. Platelets counts <10×10<sup>9</sup>/l without additional risk factors
2. Platelets counts <20×10<sup>9</sup>/l with additional risk factors (fever, sepsis, concurrent use of antibiotics, on chemo/radio therapy or other abnormalities of haemostasis)
3. Platelets counts <50×10<sup>9</sup>/l if patient is undergoing minor invasive procedure, epidural anesthesia, gastroscopy and biopsy, insertion of indwelling lines, transbronchial biopsy, liver biopsy, etc.)
4. Platelets counts <100×10<sup>9</sup>/l if patient is undergoing major surgical procedures (especially on critical sites such as brain or eyes)
5. Platelets counts <100×10<sup>9</sup>/l in patients with massive transfusion

### Therapeutic

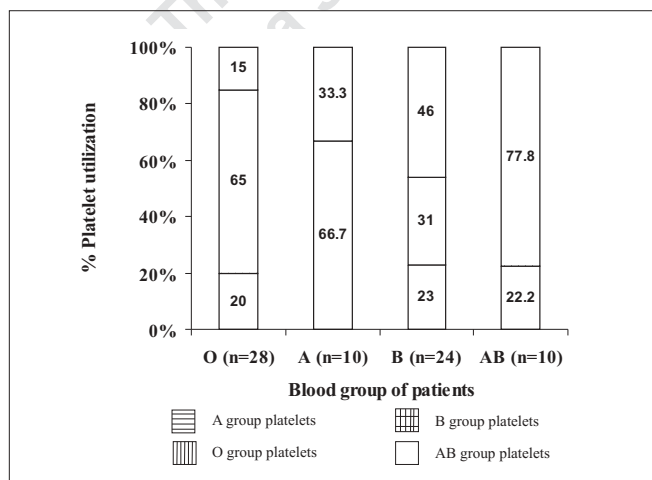
In patients with bleeds from oral cavity, mucous membranes or from any other site with platelet dysfunction irrespective of their platelets counts

**Table 3: Utilization pattern of RDP and SDP**

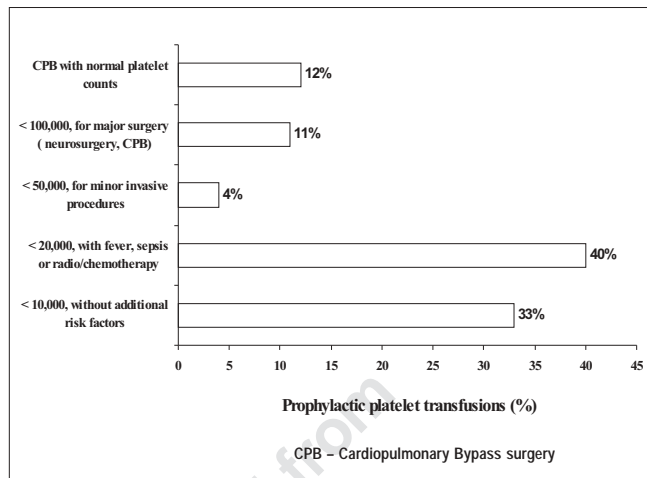
Parameters	RDP	SDP
No. of units prepared (%)	5444 (98.5%)	81 (1.5%)
No. of patients transfused	814	39
Mean age of patients in years (range)	22.7 (NB - 86)	38.4 (6-80)
Male / Female ratio	1.8:1	1.2:1
No. of transfusion episodes (range)	2012 (1-22)	81 (1-7)
No. of units transfused	3,859	81
Percentage utilization	70.8	100
Prophylactic*	26.2	77.8
Therapeutic*	73.8	22.2
Utilization by various specialties (%)		
Adult haemato-oncology	27.8	83.9
Pediatric haemato-oncology	11.3	3.7
Pediatrics	26.3	-
Neurosurgery	7.9	-
Cardio thoracic and vascular surgery	7.1	6.2
Gynecology and obstetrics	8.4	2.5
Miscellaneous (gastroenterology, general surgery, hepatology, etc.)	11.2	3.7
Expiry rate	20.8%	Nil
Wastage rate	8.45%	Nil

\*P value <0.05, NB - Newborn, RDP - Random donor platelets, SDP - Single donor platelets

SDP transfusions were of group specific platelets. Of the 3,859 RDPs transfused, 193 (5%) were given across the ABO barrier in 72 patients. The pattern of ABO nongroup specific RDP utilization is shown in Figure 2. It was observed that B group platelets were transfused in 65% of O and 77.8% of AB group patients when ABO group specific platelets were not available in the inventory. 73% of platelets were transfused prophylactically to patients either with platelet count <10,000/ $\mu$ l without additional risk factors or platelets counts <20,000/ $\mu$ l with additional risk factors (fever, sepsis, concurrent use of antibiotics, on chemo/radio therapy or other abnormalities of haemostasis) as shown in Figure 3. 88% of prophylactic platelet transfusions were appropriate as per the recommended BCSH guidelines. However, 12% of the prophylactic platelets were transfused inappropriately in cardiopulmonary bypass (CPB) surgeries with normal platelet counts and no evidence of bleeding related to platelets. Drug history was not documented in these requisitions, but platelets counts were available from the requisition forms.



**Figure 2: Utilization pattern of ABO non-group specific RDP in 72 patients**



**Figure 3: Utilization of random donor platelet concentrates for prophylactic indications**

Out of 5,444 RDPs prepared 1,585 (29.11%) units were not utilized. About 60 units (1.1%) out of these were subjected to quality control, 104 units (1.9%) were found to be TTI reactive, 287 units (5.27%) were of undesirable physical characteristics (gross red blood cell contamination, lipaemia, clot or gas formation, bag rupture or leakage during component preparation or loss of swirling) and 1,134 units (20.8%) got expired due to nonutilization during storage period. 100% of the SDP prepared were utilized. The expiry rate and wastage rate of both RDP and SDP is shown in Table 3.

## Discussion

In India, majority of blood banks are individual hospital-based and noncentralized. Blood banks perform the roles of both blood collection and transfusion centre unlike in the west, where a large blood collection and component preparation centre meets the demands of various hospital based transfusion medicine departments in its vicinity. In India, only 20% of the blood banks are preparing blood components which are grossly inadequate to cater growing patient demands.<sup>[6]</sup> Out of these, very few centers in India perform component preparation through apheresis technology or pool platelets concentrates to administer correct dose to their thrombocytopenic patients.

During the last two decades all over the world platelet utilization has increased more than the use of any other blood components.<sup>[1,4,7]</sup> On one hand, the ready availability of platelet concentrates has undoubtedly made a major contribution to modern clinical practice, in allowing the development of intense treatment regimens for hematological or other malignancies;<sup>[8]</sup> on the other hand misuse due to mishandling or inappropriate use is also prevalent. We found that 88% of the platelet transfusions were utilized appropriately with hemato-oncology specialty as the major user department. This high percentage of appropriate use of platelet transfusions was seen after educating the residents by direct interactions and release of educational material in the form of resident manual. In our study, we found that in 12% of cases platelets were inappropriately transfused in patients who underwent CPB and had a platelet count >100,000/ $\mu$ l with no clinical evidence of bleed due to platelet dysfunction. Most surgeons performing CPB have a common practice of

transfusing 3-4 units of fresh frozen plasma and 2-3 units of platelets peri-operatively without any definitive indication. Similar findings of inappropriate use of platelets are reported by Hui *et al*<sup>[9]</sup> and Cheng *et al*<sup>[10]</sup> However, prospective randomized trials have demonstrated no clinically significant benefit in terms of decrease in blood loss, platelet count, bleeding time, transfusion requirements or postoperative hospital stay in CPB patients who received prophylactic platelet transfusions.<sup>[11,12]</sup> Recently BCSH guidelines has also recommended that prophylactic platelet transfusions should not be routinely administered following CPB unless in patients who are experiencing post-operative bleeding and in whom a surgical cause of bleed has been excluded.<sup>[1]</sup>

Platelet concentrates are the most perishable blood component because of their storage at room temperature and thus the associated risk of bacterial growth at this temperature particularly beyond the shelf-life of 5 days.<sup>[13,14]</sup> In our study, we encountered expiry rate of 20.83% (1,134 units) out of 5,444 RDP units prepared. This is in sharp contrast to expiry rates of 5.8-6.4% quoted by Q-Probes study while evaluating 1,639 hospitals throughout United States.<sup>[15]</sup> This is because in our transfusion center we prepare as well as issue blood components to various clinical specialties whereas in Q-Probes study, expiry rate was calculated from units which were received by hospitals from collection centers and were not utilized during the prescribed time interval. However, no data were shown on those units, which were prepared by the collection centres according to their demand and not distributed to transfusion centres during prescribed shelf-life. Apart from this there is no other study found in literature commenting on expiry of platelet units. The mean ABO group specific RDP usage/episode was low in our study. This was because of non-acceptance by physicians in transfusing platelets across the ABO barrier, which contributed to high expiry rate. The availability of bags permitting storage of platelets up to 3 days is also a major contributing factor for high expiry rate in our study.

In order to minimize wastage and expiry rate, transfusion of ABO incompatible platelets is permissible though it is always recommended to transfuse ABO group specific platelets.<sup>[1]</sup> ABO nonidentical platelet transfusions have been associated with poorer platelet count increments in some studies,<sup>[16,17]</sup> but this is usually not clinically significant in terms of the hemostatic effectiveness of platelet transfusions. At our center, we had 5% of ABO non-group specific platelet transfusions especially when there was a therapeutic need and platelets were in short supply. We had a maximum of B group platelet transfusions when transfusing across the ABO blood group barrier as B group represents 38% of our total blood collection.<sup>[18]</sup>

This retrospective platelet audit had enlightened us regarding our existing platelet preparation, utilization and transfusion policies. Several measures have been considered to reduce high expiration rate. Firstly, performing ABO and Rh (D) grouping at the time of Hb estimation during donor screening, so that particular donor unit can be directed either for FFP-PC or cryoprecipitate-CPP preparation to maintain platelet inventory. Secondly, procurement of blood bags which permit shelf-life of platelets up to five days. Thirdly, continuous education of clinicians and nursing staff regarding platelets transportation and storage and transfusion of non-group specific platelets when there is short supply of group specific platelets.

## Conclusion

Regular audit of blood and blood components is a must so that necessary remedial measures can be taken to maximize appropriate and judicious utilization of each component.

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