Assessment of Appropriate Use of Blood Products in a Tertiary Care Center in India- An Audit Study

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ABSTRACT

BACKGROUND
The evolution of Patient Blood Management (PBM) has minimized the unnecessary use of blood products across the world. The present study was conducted to evaluate the appropriate usage of blood products in our institute.

METHODS
This study was conducted at a tertiary care hospital in New Delhi, India. This is a retrospective study and all the information regarding transfusion in different departments was collected from blood requisition forms. A total of 11,829 transfusions were evaluated in 5507 patients. The appropriate usage of blood products was assessed by WHO/NACO guidelines.

RESULTS
These patients received 11,882 transfusions (mean number of 2.21 transfusions per patient). Out of the total of 11882 requests of blood components among 5507 patients, 46.35% were of Packed Red Blood Cells (PRBC), 17.44% were of Fresh Frozen Plasma (FFP) and 36.21% requests were of platelet transfusions. The overall prevalence of appropriate demand of blood was 76.21% for all the departments. The most inappropriately used blood component was PRBC (34.37%), followed by FFP (17.47%) and platelets (13.29%) respectively. The most common cause of inappropriate use of PRBC was multiple units requested at same time without indication. Demand for FFP and platelets was inappropriate primarily due to unindicated transfusion demands and incompletely filled forms.

CONCLUSIONS
The present study emphasizes the importance of blood audit in the clinical setting. Prospective audits and bed site visits by a transfusion specialist has a key role in the implementation of Patient blood management programme.

KEYWORDS
Audit, Appropriate, Transfusion, Patient Blood Management
BACKGROUND

Blood is a very precious, scarce resource and is very critical for health care system. We should use this limited resource judiciously so that it can be used in those patients who really need it. Moreover, blood transfusion therapy is not without risks and thus should be used prudently. In recent years the concept of patient blood management (PBM) has evolved. PBM is “the timely application of evidence-based medical and surgical concepts designed to maintain haemoglobin concentration, optimize haemostasis and minimize blood loss in an effort to improve patient outcome.” There is a shift from product centric approach to patient centered approach, that is a focus on patient outcome rather than use of blood components. PBM has been adopted by the World Health Organization (WHO) as the new standard of care and all member states are urged to implement this concept. Many countries have developed guidelines and policies on the clinical use of blood. Australia is leading the world in that PBM is indeed implemented at the current time. However, despite the available guidelines, a high rate of inappropriate transfusions has been reported across the world. Few audit reports have been published from India evaluating the appropriate use of different blood components. There is a need for continuous audit of the use of blood products as therapy mainly in hospitals where there is no hospital transfusion committee. Proper monitoring of transfusion practice is necessary. A retrospective audit can scrutinize combined transfusion data and utilization trends. With this background, the present study was conducted to evaluate the appropriate usage of blood products in our institute.

METHODS

This study was conducted at Vardhman Mahavir Medical College & Safdarjung Hospital, a tertiary care 2900 bedded hospital located at New Delhi. This study included patients from the different departments- Surgery, Medicine, Obstetrics, Paediatrics, Cardiovascular Surgery, Oncology, Otolaryngology, Dermatology, Burn & Plastic, Intensive care, Neurosurgery, Urology, Respiratory medicine and Haematology. This was a retrospective study and all the information regarding transfusion was collected from requisition forms. We analysed 5507 requests in a 4-month period from April 2019 to July 2019. A total of 11,829 transfusions were evaluated in these 5507 patients. (1 unit of blood product was considered as one transfusion). The patient’s records were analysed for the following factors- Age, Sex, current clinical diagnosis, Department of hospitalization, indication for transfusion of blood product, type and amount of blood products. A review of patient’s medical history and laboratory investigations was done on each request for a blood product. The appropriate usage of blood products was assessed by WHO/NACO guidelines. The appropriate use of blood units was assessed by considering the laboratory trigger values (haemoglobin, International Normalized Ratio (INR), platelet counts along with clinical condition of the patient (actively bleeding, shock, haemolysis, imminent surgery). When the reasons of transfusion were not clear or forms were incomplete, the transfusion was considered inappropriate. The inappropriate usage of blood products was categorized as follows: multiple units requested at same time without indication, unindicated transfusion, incomplete forms, High haemoglobin or platelet threshold value.

Analysis of Data

All data were collected and statistically analysed using SPSS version 23 software. Mean rates of appropriate use ±SD were calculated and data was presented as frequency tables. The significant association of appropriate use was established by Chi-Square test, t-test and One-way ANOVA. The reasons for inappropriate use of different blood components were represented by pie charts and bar graphs.

RESULTS

This study included 5507 patients (54.06% females), Mean Age 25.46 ±17.74 years (95% CI= 24.99-25.93). These patients received 11,882 transfusions (2.21 transfusions per patient). The mean number of transfusions per patient was high in the departments of General Medicine (3.18±1.93), Cardiothoracic vascular surgery (CTVS) (3.26±1.54) and Haematology (3.03±2.01). Out of the total 11882 requests of blood components among 5507 patients, 46.35% were of Packed Red blood cells (PRBC), 17.44% were of Fresh Frozen plasma (FFP) and 36.21% requests were of platelet transfusions. The different blood components were requested from different departments. The overall prevalence of appropriate demand of blood was 76.21% for all the departments. The appropriateness of the different blood components in different departments is shown in Table 1.

Component wise, the most inappropriately used blood component was PRBC (34.37%), followed by FFP (17.47%) and Platelets (13.29%) respectively.

The cause of inappropriate demand of different blood components is shown in Figure 1. The most common cause of inappropriate use of PRBC was multiple units requested at same time without indication. Single unit PRBC transfusion was found in about 40% of total PRBCs requested.

FFP and Platelets demands were inappropriate primarily due to unindicated transfusion demands and incompletely filled forms.

DISCUSSION

The use of blood and blood components has been indiscriminate due to easy availability as well as inadequate clinical knowledge of the recommended guidelines of
component usage. One important tool for improvement of blood transfusion practice is an audit of blood requisition forms and blood component utilization. This study discusses the inappropriate use of different blood components in a large tertiary care hospital in a developing country. Very few studies are available in India and across the world evaluating the appropriate use of individual blood components. Studies assessing the appropriate usage of all the blood components are even more scarce. (Table 2) In an audit study in Venezuelan population, Carvajal et al reported that use of blood products was appropriate in 51% of cases. Two Indian studies from Rajasthan by Sharma R et al and Ankita A et al have documented overall prevalence of appropriate use of blood as 62.63% and 81% respectively. Another study from South India has shown that the appropriate use of blood and blood components is about 90%, which is a good rate. In our study, overall appropriate use of all the blood components was 76.20% which is comparable to the previous studies. In paediatric population, 91% of the transfusion episodes were appropriate which is concordant to the previous audit studies by Wade M et al and Ahmed et al. The most inappropriately used blood component was PRBC (34.37%), followed by FFP (17.47%) and Platelets (13.29%) respectively. This is concordant to the previous studies by Carvajal et al and Ankita et al. There are studies which show that FFP are most inappropriately used blood component. In paediatric population, Wade et al also reported that FFP were most inappropriately used blood component, followed by PRBC and platelets.

In our study, the most inappropriately used component was PRBC, which may be attributed to the reason that the maximum demand was for PRBC (5507 episodes out of total 11882 units requested). We will discuss the causes of inappropriate use of each blood component separately.

### Packed Red Blood Cells

In this study we found that PRBC was most inappropriately used in the departments of CTVS, Surgery, Orthopaedics, Gynaecology (p<0.05) as shown in Table 1. The mean pretransfusion Haemoglobin value of all the patients requesting for PRBC was 6.88±2.33. 16.69% patients were with haemoglobin value more than 9 gm/dL. In our study, patients with high haemoglobin values along with strong clinical indication of active bleeding or shock, the transfusion was considered appropriate. The most common cause of inappropriate PRBC transfusion was multiple units requested at same time without indication (68.46%). Single unit transfusion was seen in 41.09% of PRBC requested. (Figure 2) Two or more than two units without any clinical indication were requested in more than 58.91% PRBC Units requested with mean pretransfusion Hb Value 11.22 gm% which is much higher and is not acceptable. In CTVS department a large number of PRBC units 73.53% (375 units/510 units) were inappropriately used with the mean pretransfusion Haemoglobin value of 11.48. 286 units issued to 72 patients had mean pretransfusion haemoglobin value >10 gm/dL who were issued minimum 4 units of PRBC. Existing recent guidelines suggest that PRBC should be transfused if the Hb is <6 gm/dL and an acceptable haematocrit value between 21% and 24% if the DO2 (oxygen diffusion) is maintained above 273 mL/min/m2.

Transfusion of a single unit of PRBC should not be considered inappropriate itself; however, its use without an appropriate clinical judgement is not acceptable. According to Australian Red Cross Blood Service “where indicated, transfusion of a single unit of RBC, followed by clinical reassessment to determine the need for further transfusion, it’s appropriate. This reassessment also guides the decision to retest the haemoglobin level.” BCSC (British Committee for standards in Haematology) guidelines also state RBC transfusion should not be based upon Hb concentration alone but also be based on assessment of the patient’s clinical status. In our study, the cause of multiple units transfusion was – a) using the criteria of correcting the laboratory values alone b) the clinicians following the old concept of arranging blood units before surgeries irrespective of patient Hb values and c) there was no concept of patient blood management in the hospital. Thus, the inappropriate use of PRBC can be avoided by following the "patient centered" approach to combine the laboratory criteria with the symptoms of the patient. The clinicians and residents should be regularly trained to improve the information on the requisition forms.

### Fresh Frozen Plasma

The use of FFP has increased in the past few decades. A mis concept regarding the FFP is that it is a good volume expander and a source of albumin, probably is the cause of increased inappropriate use. The indications for the use of FFP are limited and when transfused they can have unpredictable adverse effects. FFP is given primarily for three indications: to prevent bleeding (prophylaxis), to stop bleeding (therapeutic) or for plasma exchange. Recent guidelines of British society of haematology on FFP transfusion reviews that much of the practice of plasma transfusion as prophylaxis in non-bleeding patients before invasive procedures seems unlikely to have clinical benefit; there is currently insufficient evidence to allow an evidence based recommendation on the optimal dose for FFP is 15 to 20 mL/Kg. FFP transfusions are not risk-free. Allergic reactions, fluid overload, transfusion related acute lung injury, immune suppression, haemolysis and infectious complications can all be caused by FFP transfusion. It is advised that each FFP unit should be transfused as an independent clinical decision and take into account the relative risks and benefits to the patient. Many studies have shown greater prevalence of inadequate use of FFP. Comparable data have been reported at national and international level. Lingegowda et al in his audit study of 785 FFP transfusions identified 40.64% requests for transfusion as inappropriate. Shinagare et al, Kulkarni et al and Sharma R et al showed inappropriate use of FFP 39%, 52% and 44.45% respectively. Wade et al also documented FFP to be the most misused blood product in paediatric
patients. Our study showed only 17.47% of inappropriate uses of FFP which is quite less than the other previous studies. The explanation for this result may be that while reviewing all the FFP demands, clinical condition of the patient was considered, irrespective of normal INR value or no INR value. The departments of CTVS, Orthopaedics, Nephrology, Urology, Oncology and Dermatology showed significant inappropriate use of FFP (P<0.01). Literature review has documented various reasons of inappropriate use of FFP. The common areas of misuse include volume replacement, mildly elevated PT, APTT in the absence of bleeding, hypoprothrombinemia, post-operative wound healing, prophylactic transfusion in dengue and other single or double unit transfusions which were subtherapeutic. The two common reasons for inappropriate use of FFP was incomplete forms without INR report value (53.47%) and unindicated/inappropriate transfusion (45.18%). It is necessary to do and fill coagulation test studies in order to decide the FFP transfusion. FFP must be used only as a source of clotting factors or plasma proteins. Lack of awareness among the clinicians is another important cause for the inappropriate use of FFP. It is recommended that FFP should be given in doses calculated to achieve a minimum of 30% of plasma factor concentration (usually achieved with the administration of 10-15 mL/Kg FFP). Slower rates of infusion or smaller volumes of FFP are probably ineffective. Single units were mainly requested from paediatric patients, especially those which was appropriate for age. Single or double unit subtherapeutic FFP transfusion was 7.7% among the adult population in our study. Barnett et al concluded that an educational program may help to reduce the inappropriate use of FFP.15

Platelets
In the present study, the platelets were most appropriately used with only 13.29% episodes of inappropriate platelet transfusions. Carvajal et al also showed overall a high prevalence of appropriate use of platelets (70%). However, studies by Sharma R et al and study by Wade et al on paediatric populations showed high inappropriate use of platelets 27.65% and 43.90% respectively. Platelets were mainly indicated in patients with evidence of active bleeding or ongoing surgical/invasive procedure and very low platelet count. Platelets were also indicated in patients of thrombocytopenia due to chemotherapy, leukemia or Aplastic anaemia. The departments of Haematology and Burn & Plastic treated platelets most inappropriately (<0.01). The most common reasons for the inappropriate use of platelets was mainly due to unindicated/inappropriate transfusion (50.90%) and incomplete forms without platelet count value (45.28%). This can be prevented by sensitizing the clinicians with the recent transfusion guidelines and train them to fill the requisition forms properly.

| Department          | No. of Patients Demanded | Total Units Required | Appropriate Use (n, %) | PRBC | Appropriate Use (n, %) | FFP | Appropriate Use (n, %) | Platelet | Appropriate Use (n, %) |
|---------------------|--------------------------|----------------------|------------------------|------|------------------------|-----|------------------------|----------|------------------------|
| Gynecology          | 1261                     | 2524                 | 1922 (76.15%)          | 602  | 0.938                  | 1062 (72.39%) | 0.001                 | 547 (40.15%) | 0.001                 |
| Medicine            | 842                      | 2678                 | 2382 (88.05%)          | 296  | 0.001                  | 652 (76.07%) | 0.001                 | 229 (26.90%) | 0.001                 |
| CTVS & Cardiology   | 296                      | 966                  | 328 (33.95%)           | 638  | 0.001                  | 135 (26.47%) | 0.001                 | 27 (18.42%)  | 0.001                 |
| Surgery             | 382                      | 984                  | 748 (76.02%)           | 236  | 0.001                  | 220 (38.25%) | 0.001                 | 154 (30.42%) | 0.001                 |
| Paediatrics         | 1409                     | 2076                 | 1908 (91.91%)          | 168  | 0.001                  | 641 (40.41%) | 0.001                 | 324 (20.00%) | 0.001                 |
| Nephrology and urology | 99                      | 158                  | 97 (61.39%)            | 61   | 0.001                  | 75 (55.60%) | 0.001                 | 20 (13.21%)  | 0.001                 |
| Pulmonary medicine  | 41                       | 119                  | 95 (97.83%)            | 35   | 0.351                  | 21 (60.00%) | 0.001                 | 17 (54.00%)  | 0.001                 |
| Orthopaedics        | 316                      | 572                  | 139 (59.27%)           | 233  | 0.001                  | 238 (46.64%) | 0.001                 | 8 (6.92%)    | 0.001                 |
| Oncology            | 174                      | 320                  | 220 (68.75%)           | 100  | 0.001                  | 133 (61.57%) | 0.001                 | 9 (5.92%)    | 0.001                 |
| Burns               | 287                      | 415                  | 239 (57.59%)           | 223  | 0.001                  | 174 (45.90%) | 0.001                 | 45 (23.04%)  | 0.001                 |
| Hematology          | 247                      | 749                  | 524 (59.99%)           | 225  | 0.001                  | 130 (53.94%) | 0.001                 | 15 (6.92%)   | 0.001                 |
| Intensive care       | 79                       | 210                  | 172 (81.90%)           | 38   | 0.050                  | 45 (68.18%) | 0.001                 | 21 (54.90%)  | 0.001                 |
| ENT                 | 22                       | 36                   | 38 (83.33%)            | 16   | 0.315                  | 19 (76.00%) | 0.001                 | 6 (24.00%)   | 0.001                 |
| Neurosurgery        | 48                       | 65                   | 49 (75.38%)            | 16   | 0.876                  | 41 (71.93%) | 0.001                 | 16 (24.00%)  | 0.001                 |
| Skin                | 4                        | 10                   | 2 (20.00%)             | 2    | 0.001                  | 0 (0.00%)   | 0.001                 | 0 (0.00%)    | 0.001                 |
| Total               | 5507                     | 11882                | 9055 (76.21%)          | 2827 | 0.001                  | 3614 (33.42%) | 0.001                | 1710 (14.77%) | 0.001                |

Table 1. The Appropriate Use of the Different Blood Components in Different Departments

*p (probability value) <0.05 is Significant.
CONCLUSIONS

The present study emphasizes the importance of blood audit in the clinical setting. Optimal transfusion and following guidelines will reduce the wastage of precious products, adverse effects and health care costs, especially in resource poor countries with low infrastructure. Clinicians should be made aware of the current transfusion guidelines, recent evidence-based algorithms and risks associated with blood transfusion. The clinicians should be motivated to use alternative therapies, promote autotransfusion, single unit transfusion followed by reassessment. Conducting repeated seminars, continuing medical education programs, and establishing hospital transfusion committees can play a vital
role in improving transfusion practices and optimal use of blood products. Observational trials, including “before and after” studies, are the best option to obtain data on its effectiveness. Prospective audits and bed site visits by a transfusion specialist has a key role in the implementation of patient blood management programme.

The limitations of our study were that it was a retrospective study and audit was carried out based on the information available on requisition forms only. We also did not try to assess the effectiveness of transfusion therapy. However, in our hospital, this is the first time that an audit of blood products has been carried out and these results represent the starting point from which we will be able to achieve our goal of appropriate usage of blood.

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