

# Rational use of blood components – an audit

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## Abstract

**Objectives** The present study was designed to study appropriateness of use of the blood components in pediatric and neonatal wards.

**Design** It was an observational study conducted in a tertiary care institute. The patients were selected from various pediatric subsections over a period of six months.

**Materials and methods** All the patients below 12 years of age, who received blood components in any of the pediatric subsections including general pediatric wards, pediatric intensive care unit, pediatric hematology section, neonatal intensive care unit and pediatric surgery ward were included in the study. Each transfusion episode was assessed to decide whether it satisfied the predetermined criteria.

**Results** Of the total 184 episodes of blood component transfusions, 153 (83.1%) episodes were appropriate and 31 (16.9%) episodes were inappropriate. Among these, fresh frozen plasma transfusions had highest inappropriate [18/41 (58%)] episodes followed by packed red cell transfusions [11/110 (35.5%)] and platelet transfusions [2/5 (6.45%)].

There was no inappropriate episode of cryoprecipitate transfusion.

**Conclusions** The present study reinforces the importance of blood audit in the clinical setting. Judicious implementation of guidelines for use of various blood products may help decrease the inappropriate use of blood components.

**Keywords** Audit · Blood components · Pediatric · Transfusions

## Introduction

Blood transfusions are frequently life-saving. However, transfusions are not without risks, and they should be given only when true benefits are likely [1, 2]. With the easy availability of blood products and increased risks of transfusion-transmitted diseases, proper monitoring of the transfusion practices is necessary. In spite of the sophisticated blood banking service worldwide, indiscriminate use of blood components with either no indications or inappropriate indications continues [3, 4]. Various studies depicting blood audit evaluating the appropriateness of blood transfusions have been published thereby introducing structured guidelines for use of blood products relevant to their situations [5, 6]. With this background, the present study was designed to evaluate the appropriateness of use of blood components in our institution.

## Materials and methods

The present study was conducted in a tertiary care institute. The patients were selected from various pediatric subsections including general pediatric wards, pediatric intensive

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care unit, pediatric hematology section, neonatal intensive care unit and pediatric surgery wards. All the patients below 12 years of age, receiving any blood component were included in the study. Children registered in thalassemia center receiving regular transfusions as well as those receiving growth factors were excluded from the study. A detailed history and examination of patients included in the study was recorded in a predesigned proforma. Each transfusion episode was assessed based on the predetermined criteria as mentioned below:

- I) Indications for packed red cell (PRC) transfusion [7]:
  - A) In children [1, 2, 7]
    - Acute blood loss > 25% of blood volume
    - Hemoglobin < 6 gm/dl.
    - When hemoglobin 6 – 10 gm/dl; note vital signs and tissue oxygenation
    - Hemoglobin < 8 gm/dl in perioperative period.
    - Hemoglobin < 13 gm/dl with severe cardiopulmonary disease.
    - Chronic anemia.
    - Bone marrow failure syndrome with hemoglobin < 8 gm/dl.
    - Chronic hemolytic anemia such as thalassemia/sickle cell disease.
    - Refractory anemia not corrected by pharmacological agents (such as Vitamin B<sub>12</sub>, folic acid, iron, recombinant human erythropoietin)
  - B) In neonates [7–10]
    - i) Acute blood loss with shock, give blood replacement to reestablish adequate blood volume and hematocrit of 40%.
    - ii) In neonates with anemia, transfuse with ≤ 20ml/kg, not to exceed hematocrit of 45% or hemoglobin 15gm/dl
      - Hematocrit ≤ 20% or hemoglobin ≤ 7g/dl and reticulocyte count < 4%
      - Hematocrit ≤ 25 %or hemoglobin ≤ 8gm/dl and any of following condition:
        - Episode of apnea / bradycardia ≥ 10 episodes / day or ≥ 2 episodes requiring bag and mask ventilation
        - Sustained tachycardia (>180/m) or sustained tachypnea >80 breaths/min)
        - Cessation of adequate weight gain for 4 days (≤10 gm/d despite ≥420 KJ/kg/day)
        - Mild RDS requiring, FiO<sub>2</sub> of 0.25–0.35% or nasal continuous positive airway pressure (NPCAP) with mean airway pressure (Paw) <6 cm H<sub>2</sub>O
        - Hematocrit ≤30% or hemoglobin ≤10gm / dl with mild RDS with FiO<sub>2</sub> >35% or intermittent mandatory ventilation with paw 6–8 cm H<sub>2</sub>O
        - Hematocrit ≤35% & hemoglobin <12gm/dl with severe respiratory distress syndrome requiring mechanical ventilation and paw >8 cm H<sub>2</sub>O and FiO<sub>2</sub> >50% of severe congenital heart disease are with cyanosis or congestive cardiac failure.
- II) Indications for platelet transfusions [1, 2] (not to be given in immune thrombocytopenias)
  - A) Guidelines for infants and children
    - Platelet count <50,000/mm<sup>3</sup> and invasive procedure.
    - Platelet count <20,000/mm<sup>3</sup> and presence of wet bleeding.
    - Platelet count <10,000/mm<sup>3</sup> without bleeding
    - Thrombocytopenia secondary to massive transfusion or exchange transfusion
  - B) Guidelines for platelet transfusions in neonates
    - Platelet counts < 50,000/mm<sup>3</sup> and invasive procedure
    - Platelet count < 1,00,000/mm<sup>3</sup> with bleeding
    - Platelet count < 20,000/mm<sup>3</sup> in clinically stable neonate
    - Platelet count < 1,00,000/mm<sup>3</sup> in clinically unstable neonate
- III) Indications for fresh frozen plasma transfusion [3, 7, 11]
  - Coagulation disorder associated with active bleeding
  - Coagulation disorder preoperative state.
  - Following transfusion of more than one blood volume over several hours.
  - Emergency reversal of warfarin effect
  - Anticoagulant proteins antithrombin III (AT – III) and Protein C and S
  - Plasma exchange replacement fluid for thrombotic thrombocytopenic purpura
- IV) Indications for cryoprecipitate transfusion [2]
  - Hemophilia A
  - Von Willebrand disease
  - Afribinogenemia
  - Hypofibrinogenemia

If the transfusion was given on the basis of presence of any one or more of the above preset criteria for individual component the transfusion was termed as *appropriate* or else was judged as *inappropriate*.

## Results

The present study recorded transfusion details of 85 patients receiving various blood components. Of the total 184 episodes, 53 episodes of transfusions were in the neonatal age group, 40 episodes (21.7%) were in 9–12 years, 29 episodes (15.7%) were between age group of 6 and 9 years. There were 24 (13%) and 23 (12.5%) episodes in age groups 1–3 years and 3–6 years respectively. Out of the total 184 episodes of transfusions of blood components among 85 patients, 110 episodes (59.78%) were of packed red cell transfusions, 28 episodes (15.22%) of platelet transfusions, 41 episodes (22.28%) of fresh frozen plasma and 5 episodes (2.72%) were of cryoprecipitate transfusions.

The proportion of inappropriate use of various blood components transfused amongst the total of 184 episodes is depicted in Table 1. Out of the total 184 transfusion episodes, 153 i.e. 83.1% were appropriate and 31 (16.9%) were inappropriate. Fresh frozen plasma was the most frequently inappropriately used blood component, followed by packed red cells and platelets.

On analyzing appropriateness of blood components in the different subsections of pediatric wards, (Table 2), it was found that neonatal intensive care unit (NICU) had the highest number of inappropriate transfusions followed by pediatric intensive care unit (PICU) and pediatric surgery wards. General pediatric wards and pediatric hematology section did not have any inappropriate transfusion.

In the NICU, a total of 24 (45.28%) out of the 53 episodes were inappropriate. These included 7 of 30 episodes of packed red cell transfusions (PRCs), all 15 episodes of FFP and 2 of 8 episodes of platelet transfusions. Of the 46 episodes of transfusions in PICU, 5 (10.86%) episodes were inappropriate. Of these, 2 (13.3%) of the 15 FFP transfusions and 3 (11.1%) of 27 PRCs were inappropriate. In the Pediatric Surgery wards, 2/9 (22.3%) episodes of transfusion were inappropriate. These included FFP transfusions (1/1), and [1/8 (12.5%)] PRCs transfusions.

A total of 110 episodes of packed red cell transfusions were recorded. Of these, 11 episodes (10%) were unindicated, most of which were seen in children with ventilatory support. Out of 28 episodes of platelet transfusion, 2 episodes (7.14%) judged inappropriate were given to neonates with coffee brown gastric aspirate with normal platelet counts. A total of 41 episodes of fresh frozen plasma (FFP) transfusions were studied. Eighteen episodes (43.90%) of fresh frozen plasma (FFP) were given inappropriately in

patients admitted in intensive units with coffee brown gastric aspirate. Amongst the inappropriate FFP transfusions, 15 episodes were noted in neonates with sepsis, and another in a child with hematemesis without deranged prothrombin time and INR.

## Discussion

Indiscriminate use of blood components is on the rise due to easy availability of sophisticated blood banking services. Auditing of transfusion practices therefore has become necessary. First audit of transfusion practices was done by Bock as early as 1936. Several studies have been conducted from the western world since then. However, to the best of our knowledge, most studies are done in adults and children together. There are no exclusive pediatric studies. Since there is hardly any data from our country, the present study was undertaken to review transfusion practices at a tertiary care public hospital.

The overview of appropriateness of transfusion of the various blood components showed that, of the total 184 episodes of transfusion in the different pediatric subsections, 31 (16.9%) episodes were inappropriate. The maximum number of episodes [18 (58%)] judged inappropriate were that of fresh frozen plasma transfusion, while next in frequency were packed red cell transfusion [11 episodes (35.5%)] and 2 episodes (6.45%) of platelets transfusion and none of cryoprecipitate transfusion were inappropriate. A misconception regarding fresh frozen plasma, that it is a good volume expander and a source of albumin, probably is the cause of its increased inappropriate use. In the present study, FFP was given inappropriately for coffee brown gastric aspirates without derangement of coagulation tests.

**Table 1** Appropriateness and inappropriateness of various components ( $n = 184$ )

Component	Appropriate		Inappropriate		Total
	Episode	%	Episode	%	
Packed cell	99	90	11	10	110
Platelet transfusion	26	92.86	2	7.14	28
Fresh frozen plasma	23	56.10	18	43.90	41
Cryoprecipitate	5	100	0	0	5
Total	153	83.15	31	16.85	184

**Table 2** Appropriateness of blood components in different wards ( $n = 184$ )

Wards	Appropriate	Inappropriate	Total
Pediatric	17 (11%)	0 (0%)	17 (9.2%)
Hematology	59 (38.3%)	0 (0%)	59 (32.1%)
PICU	41 (2.66%)	5 (16.2%)	46 (25%)
NICU	29 (18.8%)	24 (77.4%)	53 (28.8%)
Pediatric surgery	7 (4.54%)	2 (6.45%)	9 (4.9%)
Total	153 (83.1%)	31 (16.9%)	184 (100%)

Various other studies have also found FFP to be the most misused blood product [9–11]. Of the 11 (10%) inappropriate episodes of packed red cell transfusions, 7 (23.3%) were in neonatal intensive care unit whereas, 3 (11.1%) and 1 (12.5%) episodes occurred in the intensive pediatric care unit and pediatric surgery wards respectively. The apparent reasons for inappropriate transfusions were apprehension of immediate risk to the patient and misperception of role of PRCs in the treatment [12, 13]. Reports in literature have documented a wide range of reasons of inappropriate use of PRCs [5, 13, 14]. While a study by Hume et al. [13] found 5.9% of PRCs to be inappropriate, another study by Mozes et al. [9], depicted a much higher rate of its inappropriate use (49.6%).

In the present study, out of the total 28 platelet transfusion episodes, 2 episodes (7.14%) were inappropriate. These 2 episodes (25%) of inappropriate platelets transfusion were in neonatal intensive care unit. Emergency situations in intensive care settings may lead to inappropriate use of platelets and fresh frozen plasma too [8, 13, 15]. In the present study, 83.15 % of the transfusion episodes were appropriate. This is in corroboration with literature from the western world and suggests reasonably adequate application of judgement by the treating physicians in ordering transfusions.

Thus, in conclusion, judicious implementation of guidelines for use of various blood products may help decrease the inappropriate use of blood components and ensure their availability to larger number of needy patients as well. Awareness and education amongst all those treating children would go a long way in bringing the percentage of appropriate transfusion to nearly 100%. Auditing of blood order is a fruitful exercise to minimize the number of inappropriate transfusions, given the hazards of transfusions despite advances in making them safe.

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