

# Study of Blood Component Therapy in Neonates

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**Abstract:** ***Objectives:** Blood components used in modern day practice include, apart from whole blood, a variety of other products like Packed Red Blood Cells, Platelet Concentrates, Leucocytes and Plasma. Blood component therapy is a very common intervention practiced in new-borns. The objective of this research was to study the Indications, Pattern of usage & Acute Non-infectious Transfusion reactions of Blood Component therapy in neonates in Mahatma Gandhi Medical College & Research Institute (MGMCRI), Puducherry. **Materials and Methods:** In this study 200 neonates who received various blood component transfusion like Packed Red Blood Cells, Random Donor Platelets, Fresh Frozen Plasma and Cryoprecipitate, Whole blood (as comparator) in MGMCRI during the period of APRIL 2012 - APRIL 2014 were followed and studied in this cross sectional study. **Observation and result:** Neonatal Blood Component Therapy, Indications: Neonatal anemia - 35%, Thrombocytopenia - 53%, Others - 12%. Pattern of usage: Platelet - 53%, Packed RBC's - 35%, FFP - 10% and Cryoprecipitate - 2%. Acute Non-infectious Transfusion reactions - 6%. The study was extended to the other parameters like gestational age, sex and birth weight of the neonates also. The maximum components usage was seen in late preterm and very low birth weight babies. Most frequently used component was platelet. **Conclusion:** Increased preparation of platelets and usage of appropriate Blood Component for appropriate indication for the transfusion in neonates with minimal transfusion reactions is achieved through this study.*

**Keywords:** Whole Blood, Packed Red Blood Cells, Platelets, Fresh Frozen Plasma, Cryoprecipitate.

## 1. Introduction

Transfusion of Whole blood creates hazards to the patients was noted in the past few decades. So transfusion of Blood components has been considered, to be a low risk and safe procedure [1]. Consequently an increasing need for stricter guidelines for transfusing blood products has been recognized. Its not just for checking infections, but also to minimize the other side effects of blood transfusion[2].

In United Kingdom and other western countries, whole blood is not used for transfusion for the patients [3,4]. Routinely it is processed into various components and only that are specifically needed by the patient are used. Preterm neonates are the most frequently transfused group of patients. In that 85% of extremely low birth weight

newborns receives a transfusion by the end of their stay in hospital [4,5,6].

Use of Blood Components ensures added advantages:

i] Maximized use of one unit of blood for a number of patients with same unit. ii] Shelf life of components longer than whole blood. iii] Better patient care with specific components without danger of overloading/ side effects of other components. iv] Cost effective blood bank system wherein cost & processing a unit of blood is shared by a number of patients if given as whole blood [7-10].

Blood components used in modern day practice include, apart from whole blood, a variety of other products, like Red Blood Cell products, Leukocyte products, Platelet Concentrates and Plasma is shown in the **Table 1** [11].

**Table 1:** Various Blood products

Red blood cell products	Platelet products	Leukocyte products	Plasma	Plasma derivatives
Packed red cells	Platelet rich plasma	Granulocyte rich plasma	Fresh frozen plasma	Factor VIII Concentrate
WBC poor red cells	Platelet concentrate	Lymphocyte rich plasma	Frozen plasma	Factor IX Concentrate
WBC depleted red cells	Frozen platelets		Cryoprecipitate	AT-III Concentrate
Washed red cells			Cryo removed plasma	Factor XIII Concentrate
Frozen deglycerolized red				Albumin
				IV Immunoglobulin
				Rh Immunoglobulin

The Guidelines for the transfusion of Packed Red Blood Cells (PRBCs) varies according to age, level of sickness and hematocrit is shown in the **Table 2** [12].

**Table 2:** Guidelines for transfusion of PRBCs in neonates

i] Hematocrit <20% with low reticulocyte count with symptoms
ii] Hematocrit <30% and any of the following: a. On <35% oxygen hood b. O2 by nasal cannula. c. On CPAP and/or on ventilation d. With significant tachycardia or tachypnea (heart rate >180 beats/min or respiratory rate >80 beats /min for 24 hours). e. With significant apnea or bradycardia (>6 episodes in 12 hours or 2 episodes in 24 hours requiring bag and mask ventilation) f. With low weight gain (<10 g/day over 4 days).
iii] Hematocrit <35% and either of the following: a. On >35% oxygen hood. b. On CPAP pressure ≥6-8 cm of water.
iv] Hematocrit <45% and either of the following: a. On extracorporeal membrane oxygenation. b. With congenital cyanotic heart disease

### CPAP - Continuous positive airway pressure

The Guidelines for Platelet transfusion in neonates varies according to the platelet value range is shown in the **Table 3** [13,14].

**Table 3:** Guidelines for transfusion of Platelets in neonates

i] Platelet count less than 30,000/cubic mm: transfuse all neonates, even if asymptomatic.
ii] Platelet count 30,000 to 50,000/cubic mm: consider transfusion a) Sick or bleeding newborns b) Newborns less than 1000 gm or less than 1 week of age c) Previous major bleeding tendency (Intraventricular Hemorrhage grade 3-4) d) Newborns with concurrent coagulopathy e) e. Requiring surgery or exchange transfusion
iii] Platelet count more than 50,000 to 99,000/cubic mm: transfuse only if actively bleeding.

The Indications for the use of Fresh Frozen Plasma (FFP) in neonates is shown in the **Table 4** [15].

**Table 4:** Indications for transfusion of FFP in neonates

i] Congenital coagulopathies – rare
ii] Acquired coagulopathies a) Vitamin K deficiency; b) Disseminated intravascular coagulation; c) Liver disease – liver failure; d) Anticoagulant reversal e) Massive transfusion and DIC

The Indications for the use of Cryoprecipitate are congenital factor VIII deficiency, congenital factor XIII deficiency, afibrinogenemia & dysfibrinogenemia and Von Willebrand disease [16].

The common Acute Non-Infectious blood Transfusion Reactions that occurs in first 24 hrs of transfusion in neonates are:

- i] Acute immune mediated reactions
  - a. Immune mediated hemolysis
  - b. TRALI (Transfusion related acute lung injury)
  - c. Febrile non-hemolytic transfusion reactions (FNHTR)
  - d. Allergic reactions

- ii] Acute non immune reactions
  - a. Fluid overload
  - b. Metabolic complications
  - c. Hyperkalemia
  - d. Hypoglycemia
  - e. Acid- base derangements
  - f. Hypocalcemia and hypomagnesaemia [17-20].

## 2. Materials and Methods

To study the Indications, Pattern of usage & Acute Non-infectious Transfusion reactions of Blood Component therapy we included 200 neonates who received various blood component transfusion like Packed Red Blood Cells, Random Donor Platelets, Fresh Frozen Plasma and Cryoprecipitate in Mahatma Gandhi Medical College & Research Institute, Puducherry during the period of APRIL 2012- APRIL 2014 were followed and studied in this cross sectional study. The neonates who received Whole blood in the same study period was included as a comparator.

**Blood Bank of MGMCRI:** Our Institute runs Blood Bank Licensed for the whole blood transfusion by the Department of Drug Controller, India since 2001. Since then Whole blood transfusion practice was there. Blood Component separation and its Transfusion practice has begin in our institute since 2012 when we upgraded our infrastructure. The Blood Components that we prepare includes Packed Red Blood Cells, Random Donor Platelet Concentrate, Fresh Frozen Plasma and Cryoprecipitate.

**Statistical analysis:** Statistical methods such as Pie chart and Bar diagram were used for the descriptive purpose.

This study was approved by the ethics committee of our institution.

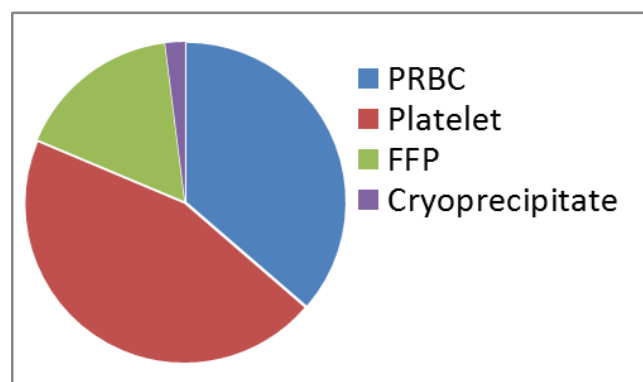
### 3. Observation and Result

The parameter which we included in our study was compared between the Whole Blood & Blood Component Transfusion in neonates is shown in the **Table 5**. The component which was used more in the neonatology group

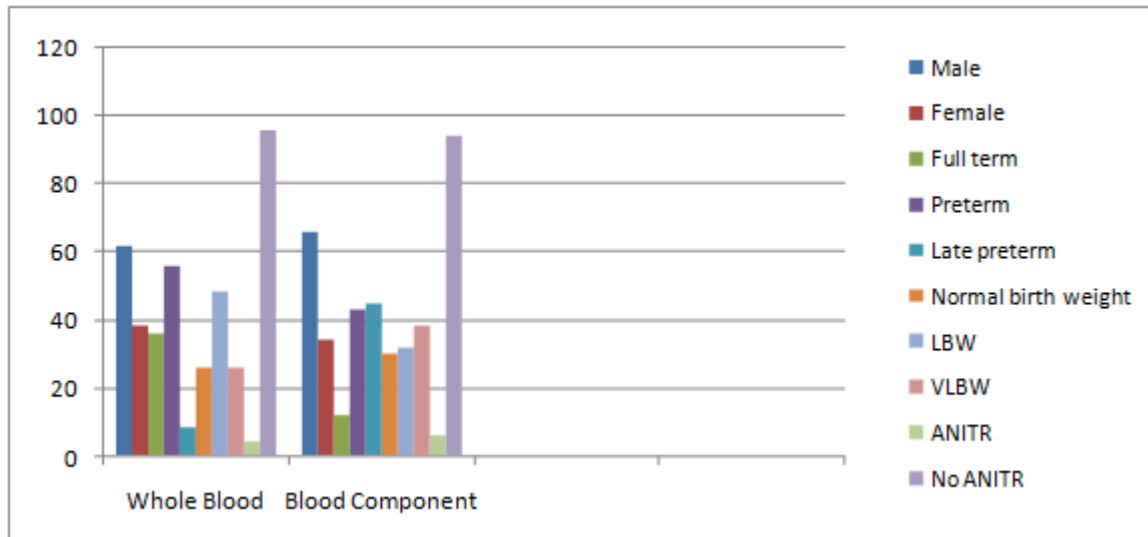
transfusion was Platelets which is shown in the pie chart **Fig.1**. The comparison between the Whole Blood & Blood Component Transfusion in neonates is shown in the statistical bar diagram **Fig.2**.

**Table 5:** Whole Blood versus Blood Component Transfusion in neonates

<i>Parameters</i>	<i>Whole blood transfusion</i>	<i>Blood component transfusion</i>
Number of Units	61	<b>600</b> PRBC - 218 (35%) Platelet - 270 ( <b>53%</b> ) FFP - 100 (10%) Cryoprecipitate - 12 (02%)
Number of Neonates	50	<b>200</b>
Sex : Male Female	<b>62%</b> 38%	<b>66%</b> 34%
Term: Full term Preterm Late Preterm	36% <b>56%</b> 8%	12% 43% <b>45%</b>
Birth Weight: Normal Low Birth Weight Very Low Birth Weight	26% <b>48%</b> 26%	30% 32% <b>38%</b>
Acute Non Infectious Transfusion Reactions: Yes	4% (2 babies) i] FNHTR – 1 (50%) ii] Hyperkalemia – 1 (50%)	6% (11 babies) i] TRALI – 1 (9%) ii] FNHTR – 7 ( <b>64%</b> ) iii] Hypoglycemia – 2 (18%) iv] Hypomagnesemia – 1 (9%)
No	<b>96%</b>	<b>94%</b>



**Figure 1:** Pattern of usage of Blood Components



**Figure 2:** Whole Blood versus Blood Component Transfusion in neonates

The Indications for each blood component that we transfused for the neonates is tabulated in the **Table 6**.

**Table 6:** Indications for the Blood Component Transfusion in neonates

Blood components	Indications for transfusion	No. of neonates
1. PRBC – 35%	Hematocrit <20% with low retic with symptoms	11
	Hematocrit 20% - 30% and on ventilation	13
	Hematocrit 20% - 30% and With significant tachycardia. HR -180/min	2
	Hematocrit 30% - 40%	4
	Hematocrit 40% - 45% and With congenital cyanotic heart disease	5
2. Platelet – 53%	Platelet count less than 30,000/cubic mm	18
	Platelet count 30,000 to 50,000/cubic mm	25
	Platelet count more than 50,000 to 99,000/cubic mm	10
3. FFP – 10%	Disseminated intravascular coagulation	4
	Bleeding Diathesis	6
4. Cryoprecipitate – 2%	Congenital factor VIII deficiency	1
	Von Willebrand disease	1

The Indications for the whole blood transfusion for the neonates is tabulated in the **Table 7**.

**Table 7:** Indications for the Whole Blood Transfusion

Criteria	No. of babies
Anemia	25 (50%)
Hb - <12g% - Anemia in 1 <sup>st</sup> 24 hours	5
Hb - 8 to 10g% - Oxygen dependency	15
Hb - ≤7g% - Late anemia	5
Exchange transfusion	10 (20%)
Others – Surgery, Bleeding diathesis & Sepsis	15 (30%)

#### 4. Discussion

The Pattern of usage of Blood Components in neonatal transfusion from APRIL 2012 – APRIL 2014 was, usage of Platelets > PRBCs > FFP > Cryoprecipitate.

The Indications of Blood Components in neonatal transfusion from APRIL 2012 – APRIL 2014 were i] PRBC transfusion in Haematocrit range 20 % - 30% was more. ii] Platelet transfusion in Platelet count 30,000 – 50,000 was more. iii] Fresh Frozen Plasma transfusion in Bleeding diathesis was more. iv] Cryoprecipitate transfusion in

Clotting factor deficiency and Von Willebrand disease in equal percentage was observed.

The Acute Non Infectious Transfusion Reactions of Blood Components transfusion in 200 neonates from APRIL 2012 – APRIL 2014: 11 (6%) babies had transfusion reactions, were noted and treated. i] Transfusion Related Acute Lung Injury (TRALI) – 1 (9%) ii] Febrile Non Hemolytic Transfusion Reaction (FNHTR) – 7 (64%) iii] Hypoglycemia – 2 (18%) iv] Hypomagnesaemia – 1 (9%). The incidence of Febrile Non Hemolytic Transfusion Reactions was more.

The other parameters observed in this study were i] Usage of Blood Components (600 units ) was more than the Whole blood (61 units) for the transfusion in neonates. ii] Male babies (66%) received more Blood Component Transfusion than Female babies. iii] Preterm (43%) and Late preterm Babies (45%) received more Blood Component Transfusion than Full term babies. iv] Very Low Birth Weight babies (38%) received more Blood Component Transfusion than Normal weight and Low Birth Weight babies. Our results were similar to other study, Bell EF, Strauss RG, Widness JA, Mahoney LT, Mock DM, et al.[4], Ohls R J [5], Richa Jain, Bipin Jose, et al.[8].

## 5. Conclusion

Through this cross sectional study we noted the transfusion of Blood was increased in general when compared to the previous years, increased transfusion of Blood Components than the Whole Blood was achieved, increased preparation of the Blood Component - Platelets was achieved since the indication for the platelet transfusion in neonates was more, usage of appropriate Blood Components for the appropriate indication for the neonates with minimal acute transfusion reactions was achieved, usage of cryoprecipitate to be increased was noted.

## 6. Future Scope

The highest achievement in this new modern era in the field of Transfusion medicine is the separation of one unit of blood into its various components for the transfusion. So more Blood component transfusion to be achieved than the whole blood transfusion, to minimise unnecessary transfusion reactions and to use one unit of blood to save many lives. So further extension of this study to the patients of all age groups who got admitted in various departments and receiving various blood component transfusions is recommended in order to know the pattern of usage and the common indications of the blood components among all age groups and to increase the preparation and storage of the blood components which is used more and to minimise acute as well as long term transfusion reactions. This can be done in all the institutions throughout the world for the same and to promote voluntary blood donation to save many lives in one unit of blood.

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