



# Patterns and Determinants of Blood and Blood Products Transfusion in Neonate: An Experience of Single Institute

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## Abstract

**BACKGROUND:** Neonates requiring intensive care are among the most frequently transfused group of patients. Indications for blood transfusion in neonates could be physiological or pathological. However, despite frequent blood transfusions in neonates in Iraq, there is a paucity of studies on its indications and patterns among neonates in our setting.

**AIM:** The aim of the study is to shed light on the details of giving blood and blood products in the unit of neonate in Children Welfare Teaching hospital, Baghdad and the justifications for giving and its complication.

**PATIENTS AND METHODS:** A descriptive study (cross-section study) includes all neonates admitted to neonatal care unit in Children Welfare Teaching Hospital. The study includes a group of newborns who were blood transfused during their admission to hospital, over a period of 6 months from October 1, 2019 to March 30, 2020. All data were collected from each patient and recorded in predesigned form, these data include patient's clinical data and analyzed using descriptive statistics.

**RESULTS:** A total number of cases admitted over a period of 6 months were 862. One hundred and forty neonates received blood and its products transfusion, (61.4%) were male and (38.6%) were female, (62.9%) received packed red blood cells (PRBCs) followed by (18.6%) received exchange transfusion, (11.4%) received Fresh frozen plasma and (7.1%) received platelets. Most neonates received blood products transfused at (3–4) weeks. Post-natal age and were term babies (37–41) weeks. Gestational age mostly received PRBCs.

**CONCLUSIONS:** Most neonates with a high rate of blood and blood product transfusion were males, term, need assistant ventilation, and transfused at 3–4 weeks postnatal age.

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## Introduction

Blood transfusion is an essential form of medical treatment, particularly in pediatric practice, where common illnesses are usually related to blood destruction or blood loss [1]. Transfusions of red blood cells (RBCs), platelets, and plasma are critical therapies for infants and neonates (particularly preterm neonates) in the neonatal intensive care unit (NICU), who are the most frequently transfused subpopulation across all ages [2]. During their stay in the NICU, the majority of extremely low-birth-weight (ELBW) infants receive at least one RBC transfusion and many end up receiving multiple transfusions [3].

Anemia becomes symptomatic when there is an imbalance between oxygen delivery and consumption which may not occur universally at the same hemoglobin (Hb) for every preterm infant [4]. Symptoms of anemia (e.g., desaturations, bradycardias, increased oxygen requirement, and tachycardia) are non-specific and can be due to alternative causes including sepsis, evolving lung conditions (including worsening respiratory distress

syndrome), or gastroesophageal reflux. Therefore, RBCT may not result in the resolution of those clinical features [5]. Anemia in neonates can be physiological, but can also be caused by non-physiological factors such as perinatal or per-partum complications, clinical conditions such as sepsis and cardiorespiratory disease, and hemolytic disease of the fetus and newborn [6]. However, one of the most important causes of anemia in very preterm neonates is iatrogenic blood loss due to frequent laboratory testing. Estimates of iatrogenic blood loss due to laboratory testing in the 1<sup>st</sup> month of life in preterm neonates admitted to a NICU may amount up to one-third of the total blood volume. The main treatment modality for neonatal anemia is still based on the administration of RBC transfusions, but there is no international consensus regarding optimal Hb thresholds for RBC transfusions in preterm neonates. Postulated Hb thresholds for transfusions vary greatly between and within countries [7]. This first study done in Iraq to discuss this issue.

This study aimed to determine the Patterns and determinants of blood products transfusion in neonates in the NICU of Children Welfare teaching hospital.

## Patients and Methods

This study was performed as descriptive (cross-sectional) study for 140 newborn babies who underwent blood and other blood products transfusions admitted to neonatal care unit (NCU) in Children Welfare Teaching Hospital over a period of 6 months from October 1, 2019 to March 30, 2020.

The study dealt with blood and blood products transfusion for all neonates who were admitted to the hospital. Inclusion criteria: All neonates admitted to NCU, receiving Blood and any other products like plasma, platelet, and candidate for exchange transfusion using whole blood at time of admission as well as babies who required transfusion days after admission were included in the study. Exclusion criteria: Neonates who were admitted to NCU who received blood in other hospital. In NCU, decisions to transfuse babies are usually taken by the resident physicians and the consultants in the unit and the indications for blood use in our unit include anemia, hemorrhage, hyperbilirubinemia need exchange transfusion, overwhelming sepsis, thrombocytopenia. Grouping and cross-matching according to standard principles precede all transfusions.

Data collection form for patients was designed to obtain all required information. All patients' data were stored and analyzed in Excel for windows and in the statistical package for the social sciences, using simple descriptive statistical analysis; included frequency, percentage, and p-value. Variables were classified according to gestational age (GA) with a significance level of  $p < 0.05$ . This study was done according to ethical guidelines of Baghdad university, faculty of medicine.

## Results

Total admissions to NICU over period 6 months were 862, 140 neonates received blood or one of the blood products during admission. The most common age group of receiving blood product transfusion was (22–28) days in 56 (40.0%), followed by those whose age (1–7) days in 39 (27.8) Concerning child's gender, 86 (61.4%) were males and 54 (38.6%) were females Table 1.

**Table 1: Neonatal demographic characteristics (n=140)**

Variables	Frequency	Percent
Age at transfusion		
<24 h	2	1.4
1–7 days	39	27.8
8–14 days	23	16.4
15–21 days	20	14.3
22–28 days	56	40.0
Gender		
Male	86	61.4
Female	54	38.6

Regarding the GA, the mean GA was  $34.98 \pm 3.13$  weeks. Concerning the type of respiratory support, 61.4% needs respiratory supports divided into mechanical ventilation in 31.4%, on nasal O<sub>2</sub> in 17.1% then on continuous positive airway pressure (CPAP) in 12.9% while (38.6%) did not receive respiratory support. Regarding the type of blood product transfused, 63% received Packed red blood cell (PRBC) followed by 18.6% underwent exchange transfusion, 12.1% received fresh frozen plasma (FFP) and 6.4% received platelets. As shown in Table 2.

**Table 2: Neonatal clinical parameters (n=140)**

Variables	Frequency	Percent
Gestational Age (Weeks)		
27–31	19	13.5
32–36	38	27.1
37–41	83	58.2
Child's weight (gram)		
<1.500	22	15.7
1.500–2.500	64	45.7
>2.500	54	38.6
Respiratory support		
Mechanical ventilation	44	31.4
CPAP	18	12.9
Nasal O <sub>2</sub>	24	17.1
No respiratory support (room air)	54	38.6
Indication of blood components transfusion		
Anemia of prematurity	39	27.8
Bleeding	3	2.1
ICH	4	2.9
Respiratory distress	6	4.3
Sepsis	60	42.9
Hyperbilirubinemia (jaundice)	26	18.5
Thrombocytopenia	2	1.4
Receiving more than one blood component		
PRBC and FFP	24	17.1
PRPC and PLT	6	4.3
PLT and FFP	4	2.9
All above	8	5.7

PRBC: Packed red blood cell, FFP: Fresh frozen plasma, PLT: Platelet, PRPC: Platelet-rich plasma cell, ICH: Intracerebral hemorrhage, CPAP: Continuous positive airway pressure.

The PRBC was the highest blood product, which was transfused in 86 times, while platelet transfusion was the lowest type of transfusion in 8 times only. Neonate at age (22–28) days was the age who received the highest percent of transfusion, 140 times while age <24 h was the age of lowest rate of transfusion, only 2 times. Packed RBCs transfusion was reported in neonate with age of 22–28 days 44 times with significant  $p = 0.001$  Table 3.

**Table 3: Association between child's age at transfusion and type of blood product transfused**

Age	No. PRBC	No. FFP	No. platelets	No. exchange transfusion	p-value
<24 h	0	0	0	2	0.001
1–7-days	24	2	2	14	
14-days	6	2	2	10	
15–21-days	12	4	2	2	
22–28-days	44	8	2	2	

PRBC: Packed red blood cell, FFP: Fresh frozen plasma.

Correlation between body weight of neonate and type of transfusion showed that the neonates with body weight 1.500–2500 kg were treated with PRBCs 42 times which is highest percent, while the lowest percent was reported in neonate with <1.500 kg who didn't receive platelet or exchange transfusion, with significant  $p = 0.003$  Table 4.

Neonate with Mechanical ventilator and room air support had the highest percent with PRBCs

**Table 4: Association between the child's weight and blood products transfusion**

Body weight	No. PRBC	No. FFP	No. Platelets	No. Exchange transfusion	p-value
<1.500	18	4	0	0	0.003
1.500–2.500	42	6	4	12	
>2.500	26	6	4	18	

PRBC: Packed red blood cell, FFP: Fresh frozen plasma.

transfusion, 28 times. While neonates with CPAP had the lowest supportive measures with blood products with significant statistical  $p = 0.001$  Table 5.

**Table 5: Association between the respiratory support and blood products transfusion**

Mode of support	No. PRBC	No. FFP	No. Platelets	No. Exchange transfusion	p-value
Mechanical Ventilator	28	8	6	2	0.001
CPAP	14	4	0	0	
Nasal O2	16	2	0	6	
Room air (No support)	28	2	2	22	

PRBC: Packed red blood cell, FFP: Fresh frozen plasma.

## Discussion

The finding in the present study showed that most transfusions in neonate involved the use of packed RBC and exchange transfusion. This study showed that the most common age group of receiving blood products transfusion was (22–28) days. This result disagree with Ogunlesi *et al.* study in Nigeria who showed that half of transfusion took place during the first week of life, because of NCU in tertiary center received most cases referred from other hospitals with delayed presentation of anemia [8].

According to the gender, this study showed that more than half of participants' gender is male, this results due to male susceptible to complication of RDS and need respiratory support so need blood transfusion more than female. Very low birthweight boys had a significantly higher mortality and more postnatal complications than girls. More than half of newborn received blood products with GA (37–41) week. Most of the newborn babies who received blood or other products were term babies because the proportion of full-term in relation to the sample size was 58% of the total number. This study not consistent with Kotowski *et al.* study in Poland [9]. While Patel *et al.* study showed that GA <27 week have high rate of transfusion (80%) with PRBCs [10].

The newborn in this study received other blood component (other than packed RBC) like plasma or platelets due to late sepsis and most of them were term baby [11]. According to the results related to weights of newborns ranged between 1500 and 2500 g. This explains that low-weight babies are more likely to have blood transfusions due to the biological status of incomplete body organs. Newborns, particularly ELBW infants who are most exposed to transfusion already were immunologically compromised and neurodevelopmental vulnerable [12].

The PRBC transfusion protocol, like other NICU protocols, includes respiratory support as criteria for transfusion levels of <6 g/dl [13]. This is in contrast to common protocols, which often use only Hb levels as criteria for transfusion, because we use respiratory status as part of our transfusion guideline [14].

This in contrast with Patel *et al.* study, which showed the median pretransfusion Hb level was 11.2 g/dl which is greater than supported by the best-available evidence and may be explained to give opportunity for improved patient blood management [10]. There was a significant relationship between age of newborn and the blood transfusion process, and it can be interpreted that the child's age when it is less than normal accompanies complications when transfusing blood, this concept is supported by what was documented in Pedrosa *et al.* study which shows relationship between age and transfusion reaction [15].

There is a significant correlation between respiratory support and transfusion of blood products (Table 5,  $p = 0.001$ ), and according to the results, most of the neonates were under assisted ventilation include mechanical Ventilation; CPAP and nasal O2 in 61.4% compared to newborn in room air 38.6%. Very recent review study concluded that Hb transfusion thresholds within the ranges used in these trials, 11–13 g/dL for young critically ill or ventilated infants and 7–10 g/dL for stable infants not requiring significant respiratory support, can be safely used without expecting adverse consequences on survival or neurodevelopment [16].

## Conclusions

The detailed study of blood and blood products transfusion to premature infants is of great importance to the pediatrician in avoiding unwanted complications or making the right decision at the right time.

## Limitation of Study

The lack of all types of blood products at all times, according to the capabilities available in the blood bank. Absence of some basic information as a result of short medical registration.

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