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ORIGINAL RESEARCH

Blood Component Therapy in Sick Newborns

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Abstract

Background: Sick neonates admitted to NICU (neonatal intensive care unit) frequently need blood component transfusion including WB (whole blood), PRBC (packed red blood cells), FFP (fresh frozen plasma) and platelets.

Aim: This study was aimed to evaluate the indication and frequency of various blood components used in NICU.

Method: This was retrospective observational study, done at tertiary level NICU in north India. All the neonates admitted in NICU from July 2023 to December 2023 were included and their records were screened for blood component transfused and their indications.

Results: During the study period, out of 141 admissions, 15.6% of newborns required blood component transfusion. PRBC (53.3%) was the most commonly transfused component followed by platelet concentrate (28.9%). 41% of newborns required more than one transfusion. 91.1% of transfusions were appropriate as per our NICU transfusion protocol.

Conclusion: A large number of sick newborns admitted to NICU required blood component transfusion during hospitalization, especially preterm. PRBC, being the most commonly used blood component, should be used appropriately and judiciously.

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Introduction

Sick neonates admitted to neonatal intensive care units (NICUs) frequently need blood component transfusions for various indications. Various blood components used in NICU are whole blood (WB), packed red blood cells (PRBC), fresh frozen plasma (FFP), and platelet concentrates (PC). With the advancement in management, sick neonates especially preterms, have prolonged NICU stay and transfusion requirements for various reasons. Blood component therapy (BCT) is one of the common intervention practices in NICU and approximately 85% of extremely low birth weight babies admitted in NICUs require blood component transfusion at some point of time during their hospital stay.[1]

In sick newborns, the common indications for BCT are anemia, thrombocytopenia, bleeding, surgical interventions and sepsis. Although various interventions and strict transfusion guidelines are being followed to reduce the requirement of BCT in newborns but transfusions are still being frequently done as a part of

management for various indications.[2-6] The use of blood components in neonates varies across different hospitals. Although the guidelines and protocols for blood component transfusion from various premier institutes exist,[3-6] yet there is paucity of Indian data regarding the actual blood component usage. Thus, the present study was conducted to know the incidence of BCT used in tertiary-level NICUs in northern India and their indications.

Methodology

Our hospital is a charitable hospital with a 10-bed tertiary-level NICU, which caters to neonates suffering from various critical diseases including medical as well as surgical, from adjacent districts and states.

We conducted a retrospective, record-based study. All the newborns admitted to NICU from May 2023 to December 2023 were included. Their records were screened for BCT given and detailed information about demographic data, an indication of transfusion, the components transfused, number of transfusions, transfusion reaction if any, relevant investigations, final diagnosis, and outcome was noted in a predesigned proforma. The outcome was noted as discharged, expired, referred, and left against medical advice.

Our hospital has a certified blood bank that provides WB and its various components, i.e. PRBC, FFP, and PC. As indication of transfusion of blood components in the NICU varies in different institution so our NICU protocols for BCT are given in Table 1. PRBC transfusion is done with 10 to 15 mL/kg over 3 to 4 hours with a maximum rate of 5 mL/kg/hour. Platelets are given 10 to 20 mL/kg, starting at a slow rate; if no reaction occurs then the rate is increased to complete the transfusion within 1 hour. FFP transfusion is done at 15 to 20 mL/kg over 30 to 60 minutes. The patient's identity was not disclosed in the study, the institutional ethical committee waived off the ethical clearance.

Table 1: Indication of blood transfusion therapy in newborns.

Blood component	**Indication**
PRBC transfusion	**1. On respiratory support** hemoglobin (gm/dL) 1st week - <11.5 2nd week- <10.5 3rd week or more- <8.5 **2. No respiratory support** 1st week - <10 2nd week- <8.5 3rd week or more- <7.5
Platelet transfusion	**1. < 25,000/mm^3** All neonates, even if asymptomatic **2. 25,000 to 50,000/mm^3** • Bleeding neonates • Before surgery • Concurrent coagulopathy **3. 50,000 to 100,000/mm^3** • Major bleeding • Major surgery
FFP transfusion	1. Disseminated intravascular coagulopathy (DIC) 2. Vitamin K deficiency bleeding 3. Neonates with bleeding and significant coagulopathy 4. Neonates with significant coagulopathy who have to undergo invasive procedures with at risk of significant bleeding.
WB transfusion	Exchange transfusion

Results

A total of 141 newborns were admitted during the study period, out of which 22 (15.6%) newborns needed BCT. 69% were preterm while 37% were term, 40% were low birth weight, 22% and 16% were very low and extremely low birth weight respectively (table- 2). A total of 45 units were transfused including 24 (53.3%) units PRBC, 7(15.6%) units FFP, 13(28.9%) units PC and 1(2.2%) unit WB (Table 3). 59% of newborns needed single blood component transfusion while 41% needed multiple transfusions. 4 units were transfused in neonates within 3 days of life while rest units were transfused after 3 days of life. 7 newborns had more than one type of blood component transfusion. 1 developed febrile nonhemolytic transfusion reaction. 6 patients in our study group had culture-proven sepsis out of which 5 needed multiple transfusions. The indications of BCT were followed in 41 transfused units (91.1%), but 4 PRBC units (17%) were transfused inappropriately (Table 4). In our study group, 18 (81.8%) newborns were discharged, 3 expired and 1 was referred i/v/o inborn errors of metabolism.

Table 2: Baseline variables.

Variables	Total number	Percentage (%)
Gender		
Male	14	63
Female	08	37
2. Birth weight		
>2500 gm	5	22
1500–2499 gm	9	40
1000–1499 gm	5	22
<1000 gm	3	16
Gestation age		
Term	07	31
Preterm	15	69
Mode of delivery		
Normal vaginal	3	16
Caesarian section	19	84

Table 3: Blood component transfusion details.

Blood component	Number of neonates	Total units transfused (%)
PRBC	13	24(53.3%)
PC	7	13(28.9%)
FFP	7	7(15.6%)
WB	1	1(2.2%)

Table 4: Blood component indications

Blood component	Indication	Number of transfusions (%)
PRBC	On respiratory support hemoglobin (gm/dL) 1st week - <11.5 2nd week- <10.5 3rd week or more- <8.5 2.No respiratory support 1st week - <10 2nd week- <8.5 3rd week or more- <7.5	 4(16.7%) 6(25%) 6(25%) 0(0%) 2(8.3%) 2(8.3%)
PC	<25,000 /mm^3 25,000–50,000 mm^3 with bleeding 50,000–1,00,000 mm^3	9(69%) 3(23%) 1(7%)
FFP	DIC Neonates with bleeding and significant coagulopathy	2(28%) 5(72%)
WB	Exchange transfusion	1(100%)

Discussion

Blood components are very often lifesaving health resources.[7] With lot of advancement in transfusion medicine and more use of blood component rather than using whole blood, the BCT have become safer than before,[8] but still associated with infectious and non-infectious complications, and, so they should be used judiciously. Thus, this study was conducted to review BCT uses, their indications and frequency in our NICU.

15.6% of all admitted sick newborns were given one or more BCT during their NICU stay in our study. Dogra *et al.*[9] reported 21.1% of admitted newborns required BCT while Kaur A *et al.*[10] reported 34.3%.

Anemia, thrombocytopenia and deranged coagulogram are frequent in sick newborns especially preterm thus BCT is used widely during their management in the NICU. In our study, out of all newborn who received BCT; 69% were preterm and 76% were having birth weight <2.5 kg. Our results were in line with studies done by Ayede Al *et al.* and Vinayaka P *et al.*[11,12]

Most frequently used component in our NICU during study period was PRBC (53.3%) followed by PC (28.8%), FFP (28.9%) and WB (2.2%). In study done by Giridharan J *et al.*[13] it was PC 42% followed by PRBC 34% and FFP 23% while Amrutiya

R J *et al*.[14] reported FFP (37.82%) being commonly used followed by PRBC (31.34%) and PC (28.14%). Indication of BCT depends on gestational age, days of life and severity of illness, as well as the transfusion protocols differ widely among NICUs as discussed above, which explains differences in incidences of different components used. In our study group, 41% of sick newborns received more than one transfusion. 72% of babies needing BCT were diagnosed as neonatal sepsis, 27.2% of newborns had culture-proven sepsis out of them 82% required multiple transfusions. Other studies also show a high prevalence of sepsis in newborns requiring BCT.

While other studies showed incidences of inappropriate blood component uses ranging from10 to 39% platelet transfusion was most common in them.[15-17] 91.1% BCT done were appropriate in our study as per our NICU protocols, the inappropriate transfusions were mostly PRBC in surgical patients.

Conclusion

BCT is frequently used in the management of sick newborns, especially in preterm and birth weight less than 2.5 kg. BCT should be used cautiously and appropriately.

Limitations of our study were small sample size, single-center and retrospective nature of the study.

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