

Packed Red Blood Cell Transfusion Practice in Pediatric Intensive Care Unit

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Abstract

Background: Transfusion of packed red blood cells is an important aspect of care in the critically ill children. The decision to administer PRC should be taken only after weighing the benefits and the risks of PRC transfusion against those of anaemia. *Aims:* To study the outcome of PRC transfusion in pediatric intensive care unit. *Settings and Design:* Prospective observational study, conducted in PICU of the Dept. of Pediatrics in AVBRH. *Material and Method:* In a study period of 2 years, out of 1565 patients admitted in the PICU, 164 patients required PRC transfusion were included in the study. Detailed history was taken and baseline clinical informations, investigations and administration of PRC with its indications and outcome were done. *Statistical Analysis:* Statistical analysis was done by using SPSS 17.0, $p < 0.05$ is considered as level of significance. *Results:* The mean age of our patient population was 6.62 ± 4.81 yrs. Maximum 18.9% of patients had hematological and 18.9% had cardiovascular involvement. Mean pre-transfusion Hb was 8.11 ± 2.70 g/dl. The average days of PICU stay for patients transfused with PRC was 5.9 days. Most common indication was Anemia (35.97%), while the mortality rate was 33.54%. *Conclusions:* Anemia was a common co - morbidity in critically ill pediatric patients. The PRC transfusion was associated with higher mortality in PICU.

Keywords: Anemia; Transfusion; Intensive Care.

Introduction

Transfusion of different blood components especially that of packed red blood cells (PRC), is an important aspect of care in the critically ill children. The overall incidence of Packed red cell transfusion has been reported as 17% among all pediatric intensive care unit (PICU) patients and around 50% in children with a stay longer than 48 hours [1]. For the clinicians, managing critically ill patients, blood transfusions constitute an indisputable part of treatment arsenal. However, to whom, when and what to transfuse is surrounded with a lot of uncertainties. Thus, the present study is undertaken to assess the outcome of PRC transfusion practice in PICU.

Methodology

It was a prospective observational study conducted on the pediatric patients admitted to 10 bed PICU of the Department of Pediatrics at Acharya Vinoba Bhave Rural Hospital, Sawangi (Meghe) Wardha. The study duration was 2 years, from 1st September 2015 to 31st August 2017. During the course of study, 1565 patients were admitted to the PICU. Out of these, total of 164 patients, required and needed PRC transfusion were included in the study. Informed Consents were taken from parents of all children included in this study. Detailed history was taken and prospectively collection of demographic and baseline clinical informations (age, gender, diagnostic category), investigations and administration of PRC with its

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indications and outcome in the form of deaths and discharged were done.

Results

Total 1565 patients admitted in PICU out of which 164 (10.47%) patients required and needed PRC transfusion. As shown in table 1, maximum 31 (18.90%) patients had hematological and cardiovascular system involved and had given mean of 2.12 ± 1.38

and 1.48 ± 0.67 no. of transfusion respectively, followed by neurological involvement in 20 (12.2%) patients who had given a mean of 1.35 ± 0.48 no. of transfusions. Minimum 4 (2.44%) patients had nutritional involvement and had given mean of 1.50 ± 0.57 no. of transfusions.

In our study, the mean pre-transfusion Hemoglobin (Hb) of the study population receiving PRC transfusion was 8.11 ± 2.70 g/dl, out of 164 patients receiving PRC transfusion, minimum 3.6% of patients had pre transfusion Hb > 10 while, maximum 21.3%

Table 1: Number of Patients with PRC Transfusion and System involved

System Involved	No of patients	PRC Transfusion
		Mean Transfusion
Hematological	31(18.90%)	2.12 ± 1.38
Cardiovascular	31(18.90%)	1.48 ± 0.67
Neurological	20(12.20%)	1.35 ± 0.48
Respiratory	18(10.98%)	1.22 ± 0.42
GIT	16(9.76%)	1.31 ± 0.47
Others	14(8.54%)	1.71 ± 0.61
Surgical	8(4.88%)	1.77 ± 0.83
Infections	8(4.88%)	1.37 ± 0.74
Renal	8(4.88%)	1.37 ± 0.51
Septicemia	6(3.66%)	1.16 ± 0.40
Nutrition	4 (2.44%)	1.50 ± 0.57
Total	164(100%)	1.55 ± 0.84

Table 2: Comparison of pre and post transfusion Hb with PRC Transfusion

Hb%	Pre Transfusion Hb% No of Patients	Post Transfusion Hb% No of Patients
>10	6(3.6%)	85(51.8%)
9.1-10	28(17%)	33(20.1%)
8.1-9	32(19.5%)	20(12.1%)
7.1-8	35(21.3%)	13(7.9%)
6.1-7	29(17.6%)	9(5.4%)
≤6	34(20.7%)	4(2.4%)
Total	164(100%)	164(100%)

Table 3: Number of Patients with PRC Transfusion and Indications

Indications	No of Patients	PRC Transfusion
		Mean Transfusion SD
Anemia	59(35.97%)	1.49 ± 0.64
Anemia with shock	50(30.48%)	1.48 ± 0.61
Surgical	17(10.36%)	1.61 ± 0.84
Anemia with thrombocytopenia	14(8.5%)	1.85 ± 1.83
Anemia with DIC	10(6%)	1.60 ± 0.84
Anemia with shock with thrombocytopenia	9(5.4%)	2.00 ± 1.00
Thrombocytopenia	3(1.8%)	1.66 ± 1.15
Thrombocytopenia with shock	1(0.6%)	1.00 ± 0.00
Trauma	1(0.6%)	2.00 ± 0.00
Total	164(100%)	1.55 ± 0.84

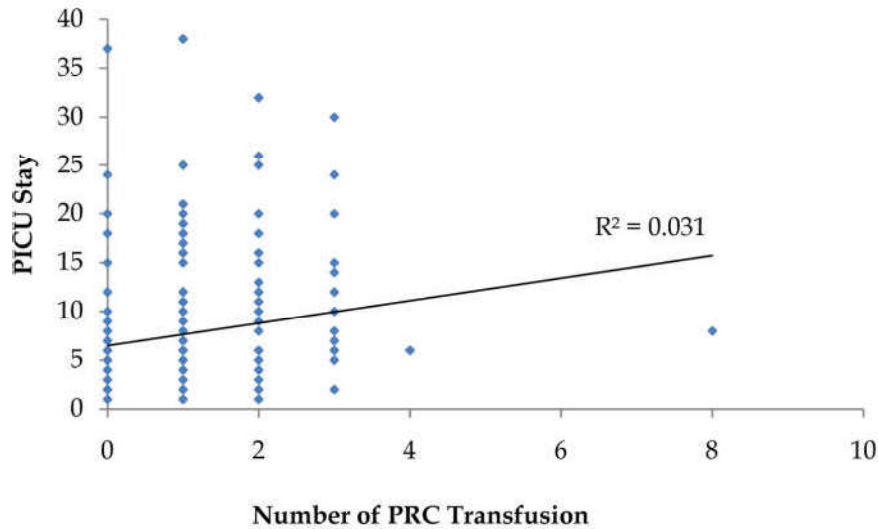


Fig. 1: Pearson’s Correlation Coefficient between PICU stay and PRC transfusions

of patients had pre-transfusion Hb of 7.1 – 8 as shown in Table 2. Moreover, maximum 51.8% of patients had post transfusion Hb >10 and minimum 2.4% of patients had Hb ≤ 6 post transfusion. By using Chi square test, statistical significant association was found between pre and post transfusion Hb (χ^2 -value 116.10, p- value - 0.0001).

As shown in Figure 1, the average days of PICU stay for patients transfused with PRC was 5.9, there was positive correlation ($r = 0.164$) between PICU stay and no. of transfusion which was statistically significant (p value=0.008).

Out of 164 patients receiving PRC transfusion, maximum 59 (35.9%) patients had anemia who were given a mean of 1.49 ± 0.64 no. of transfusions as shown in table 3. Moreover 50 (30.48%) patients had anemia with shock who were given mean of 1.48 ± 0.61 no. of transfusions.

Out of 164 patients receiving PRC transfusion, 109 (66.46%) patients were discharged and 55 (33.54%) patients were deaths, significant association was found between deaths and discharged. (χ^2 - value - 20.48, p-value - 0.0001, S).

Discussion

Blood component transfusion is an integral part of the treatment of many infants and children cared for by general pediatricians, surgeons, intensivists, and hematologists/oncologists. Nearly 50% of children admitted to PICU receive blood transfusions [1]. Technologic advances in blood collection, separation, anticoagulation, and preservation have resulted in

component preparation of red blood cells (RBCs), platelets, white blood cells (WBCs), and plasma, which are superior to whole blood (WB) used in the past. Transfusion practices differ widely among pediatric care units depending upon individual preferences, hospital transfusion policy and resource availability. There is a need to implement best transfusion practices and despite the lack of firm evidences, existing pediatric transfusion guidelines can help pediatric care providers in their decisions related to component transfusion. Thus, the present study was undertaken to assess the outcome of PRC transfusion practice in PICU, was conducted on the pediatric patients admitted to PICU of the Dept. of Pediatrics in AVBRH, Sawangi. During the course of 2 yrs of the study, 1565 patients were admitted to the PICU. Out of these, total of 164 patients, who required PRC transfusion, were included in the study.

In a recent study by Dallman et al [2], on transfusion practice changes in PICUs overall PRC transfusions given were 6.8%. Armano R et al [1] in a prospective study on determinants of red blood cell transfusions in a pediatric critical care unit noticed that there were 1047 admission out of which 985 patients retained and PRC transfusion was given to 139 patients (14%). During the course of this study, total 1565 patients were admitted in PICU, out of which 164 (10.48%) patients received PRC transfusions. Bateman ST et al [3] in their prospective multicenter observational study of blood transfusion in North American children in the ICU noticed that out of 475 patients receiving PRC transfusion, maximum 39% of patients had CVS involvement, followed by respiratory involvement in 23% and CNS involvement in 17%, GIT - 8%, hematologic-7%, renal - 3%, endocrine

1%. Goodman A M et al [4] in their study of pediatric red cell transfusions increase resource use found out of 131 patients receiving PRC transfusion maximum 22.8% of patients had orthopedic involvement followed by infectious 16.8% and oncologic 16%, respiratory 9.2% trauma 9.2%, hematologic 8.4%, GIT 4.6%, genitourinary 4.6%, Neurologic 2.3%, Neurosurgical 2.3%, immunologic 1.5%, cardiac 1.5%, endocrine 0.8%, genetic 0.8%. Armano R et al [1] found out of 139 patients receiving transfusion maximum 57.9% of patients had respiratory involvement followed by surgical (elective, cardiac and noncardiac surgery) 51.8%, shock 9.2%, infectious 5%, trauma 5.1%. Both these studies were performed in children. In our study, out of 164 patients receiving PRC transfusion maximum 18.90% of patients had hematological and cardiovascular system involvement, followed by CNS involvement in 20% patients.

Goodman A M et al [4] found in their study, the average PICU stay was 8.6 days and transfusion was associated with increase in PICU stay duration. Bateman S T et al [3] observed that the transfused group had a longer PICU length of stay (7.5 d in non-transfused vs. 9.3 d in transfused). In our study, the average days of PICU stay for patients transfused with PRC was 5.9 and there was a positive correlation between PRC transfusion and PICU stay, which was statistically significant. Armano R et al [1] found that, mean pretransfusion Hb concentration was 8.8 ± 2.6 g/dl. Ahmed et al [5] found the mean pre-transfusion hemoglobin for red blood cell transfusion to be 7.45 ± 1.58 . Dallman M D et al [2] in their study on transfusion practice changes in PICUs, analyzed the mean pre-transfusion Hb over time period found a decrease in the transfusion threshold for the first discrete RBC transfusion event, from 10.5 mg/dl in 1998- 1999 to 9.3 g/dl in 2009-2010, though this did not meet the traditional definition of significance ($p=0.09$). In 2009, 70.3% of patients were transfused at a Hb threshold above 7.0 g/dl. Chegondi M et al [6] found that the mean hemoglobin threshold for transfusion in their unit was 7.3 g/dl and differed according to the underlying clinical condition group. It was higher for acute blood loss and unstable patients compared to hematologic and stable patients. In our study, the mean pre-transfusion Hb of the study population receiving PRC transfusion was 8.11 ± 2.70 g/dl.

Bateman S T et al [3] in their study found that low Hb was the most common reason listed (42%), followed by acute blood loss (gastrointestinal bleeding/surgical procedures) 16%. Mendes C et al [7] in their study on red blood cell transfusion practice

in a PICU noted, the main reason for the indication of a RBC transfusion is low Hb concentration and hematocrit. In our study the most common indication for PRC transfusion was anemia (35.97%) followed by anemia with shock (30.48%) and surgical intervention (10.36%). In 2003, Goodman M A et al [4] in their study found that mortality was 26% in transfused cases among 3 out of 5 PICUs. In 2003, at the Netherlands, Kneyber M C J et al [8] conducted a retrospective, descriptive epidemiologic cohort study in a Single-center, PICU to test the hypothesis that RBC transfusion in critically ill children is independently associated with increased mortality and morbidity. In their study among patients who had received one or more RBC transfusion mortality rate (16.4 vs. 2.6%, $p < 0.001$) was observed. In 2000, at Canada Armano R et al [1] found that mortality was 12.9% among transfused cases. While in our study 164 patients receiving PRC transfusion, mortality rate was 33.54% among transfused patients and 66.46% patients were discharged.

Conclusion

Anemia was a common co-morbidity in critically ill pediatric patients. The common indications for PRC transfusions were anemia, anemia with shock and surgical interventions. Among the patients, who received PRC transfusion, 66.46% patients were discharged while 33.54% patients died. Statistically significant association was found between PRC transfusion and Outcome.

Limitations

1. The present study does not consider non-transfused group therefore we couldn't compare the outcome between the two groups (transfused and non-transfused group). We couldn't assess whether the outcome is associated to blood transfusion or underlying illness.
2. Follow-up of the discharged patients could not be done.

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