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Transfusion of red blood cells in neonatology

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Abstract

Blood transfusion in the neonatal period remains a therapeutic act , that no one dares to consider it as perfectly innocuous and that it is advisable to make rare, considering its risks as well immunological as infectious. The present work is a retrospective study, conducted in neonatal intensive care unit, in the University Hospital MOHAMED VI, Marrakech, during the period from January 1st to December 31st, 2019. All newborns were included in this work, who received one or multiple transfusions of red blood cells (RBC). Our study covered 60 neonates with a total of birth: 794 neonates, with a prevalence of 7.55%, hospitalized for various indications (60% of newborns were at term, 31.7% premature and 8, 33% were post-mature. The majority of transfusion procedures were performed during the first week of life. This is explained by the frequency of haemolytic anemias by fœto-maternal incompatibility. The main indications for transfusion were haemolysis, anemic syndrome and haemorrhagic syndrome. The average number of transfusion episodes was 1.95 +/- 1.47 per patient. Newborns were polytransfused in 18.33% of cases. A single transfusion accident was found in our study. However, we did not observe a correlation between the maternal diseases, the state of the newborn, and the transfusional indication.

Keywords: Anemia, Red Blood Cells, Single Donor, Blood Transfusion, Newborn

Major classifications: Health Science

1. Introduction

Blood transfusion is a replacement therapy which consists in transfusing blood or one of its cellular or plasma components from one or more person called "donors" to one or more sick person called "recipients" (Khodabux & Brand, 2006). The use of this blood transfusion is frequent in newborns, mainly premature babies. Factors favoring premature anemia are blood spoliation by multiple swabs, a shorter lifespan of red blood cells, rapid weight gain and inadequate production of erythropoietin (Arnaud & Simeoni, 2006). It is necessary to establish the single donor protocol (SDP) in our hospital, given many blood transfusions and most often in the same newborn.

The objectives of this work are: Evaluate the consumption of red blood cells (RBC) in our department, support the different clinical and biological situations leading to the practice of blood transfusion and try to establish a SDP in our neonatal care unit.

2. Patients And Methods

Our work is a retrospective and descriptive study; performed in the neonatal care unit, the University hospital, Mohamed VI in Marrakech. The study was conducted over a year from January 1st to December 31 st, 2019. All newborns who received one or more product in many transfusions were included in this study.

3. Results

Among 794 newborns who are hospitalized, 60 newborns were transfused, representing a hospital prevalence of 7.5%. The ages of hospitalized newborns ranged from one day to 44 days.

A proportion of 50% of newborns who were less than 7 days old, 38.33% from 7 to 28 days and 11.67% more than 28 days. Our patients had a gestational age that ranged from 35 to 44 weeks of gestation. Premature babies represented 31.67%, 60% of term newborns and 8.33% of post-mature babies.

Our population included 33 boys and 27 girls, a sex ratio was1.22. There is 38.3% of transfused infants were hospitalized for neonatal jaundice, while 16.7% were hospitalized for anemic syndrome (fig. 1).

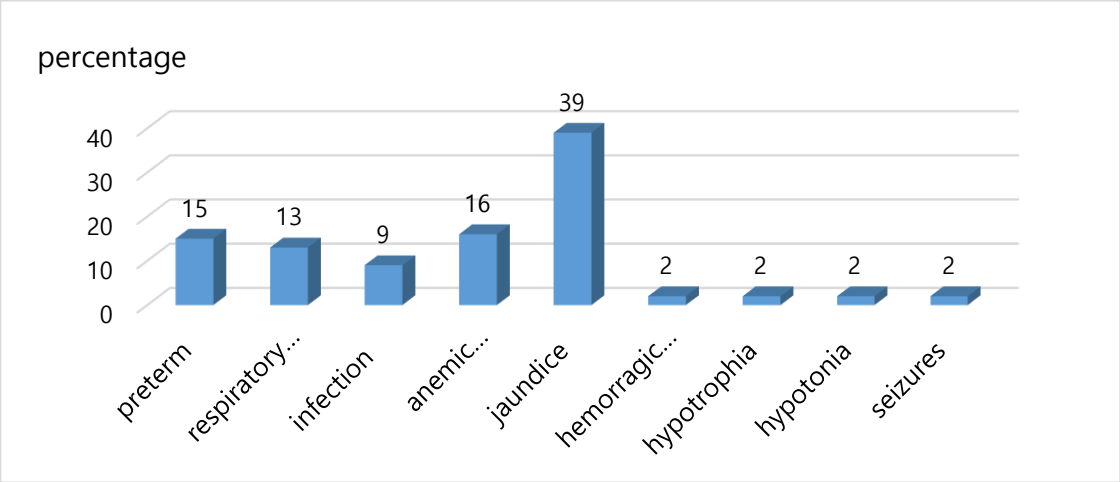

Figure 1: Hospitalisation indications

Maternal hemorrhage was found only in 8 mothers, or 6.67% cases of placenta previa type, first trimester metrorrhagia and Help syndrome. Maternal anemic syndrome was found in 10% of the cases, or 6 women. No history of transfusion in the mother during pregnancy was shown. The history of iron deficiency anemia in siblings was found in 6.67% of cases.

The delivery took place vaginally in 81.67% of mothers and by cesarean section in 18.33% of mothers. Normal weight was found in 50%, hypotrophy in 30%, with extremes of 1500g to 4000g in 20% of cases.

The clinical anemic syndrome was found in 58.3% of the cases, or 35 newborns, made of: cutaneous-mucous pallor and discolored conjunctiva. Only 8 neonates, or 13.3%, had purpura-like clinical hemorrhagic syndrome in 4 neonates, petechiae in 2 neonates and re-bleeding in 2 neonates. Jaundice of hemolytic origin was found in 65% of cases.

In our study the biological examinations were the grouping of the newborn and the mother, the blood count and the coombs test. Other assessments were done depending on the context: the hemostasis assessment, the bilirubin dosage and the blood inogram. The distribution of the newborns according to the blood groups had revealed the predominance of the groups O + and A +. Grouping was not done in 9 cases in the face of life-threatening emergency.

Transfused infants had positive rhesus in 90.20% of cases, while in 9.80% of cases had negative rhesus (table 1)

Table 1: Newborn grouping

Grouping	Number	Percentage
A^+	18	30%
O^+	18	30%
B^+	7	11,7%
AB^+	3	5%
O^-	3	5%
A^-	1	1,7%
B^-	1	1,7%
Unknown	9	15%

The distribution according to the mother's blood group had shown a predominance of group A- (20%). The mother had not a group in 10 cases due to the clinical or low economic status of the mothers; 58% of the mothers had a negative rhesus, while in 42% of the cases they had a positive rhesus (table 2).

Table 2: Mother's grouping

Grouping	Number	Percentage
O^+	9	15%
A^+	7	11,7%
B^+	4	6,7%
AB^+	1	1,7%
A^-	12	20%
O^-	11	18,3%
B^-	5	8,3%
AB^-	1	1,7%
Unknown	10	16,7%

A positive Coombs test was found in 11.66% newborns with hemolytic anemia.

In all cases, the hemoglobin level was less than 12g / dl before the transfusion of RBC. The hemoglobin level of less than 7g / dl was found in 30% of the cases. In 10% of cases, the hemoglobin level was greater than 10 g / dl in infants on invasive ventilation (fig. 2).

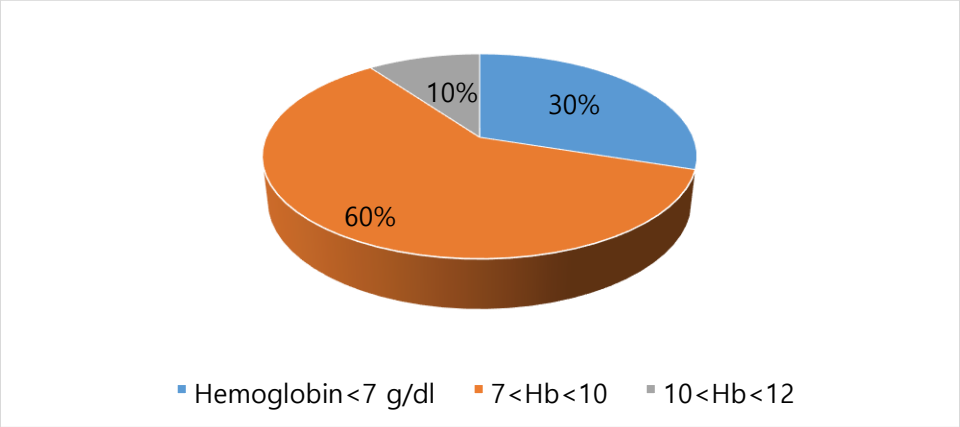

Figure 2: Hemoglobin level before transfusion

The transfused newborns had in the majority of cases received RBC of O- (83.33%), while in 11.67% of the cases they had received iso group iso rhesus blood.

The average amount of blood transfused in the 60 hospitalized newborns was: 88.07 ml +/- 6.69 ml.

The main indications for RBC transfusion were hemolysis in 66.67% of the cases, anemic syndrome in 26.67% of the cases and hemorrhagic syndrome in 6.67% of the cases, respectively (fig .3).

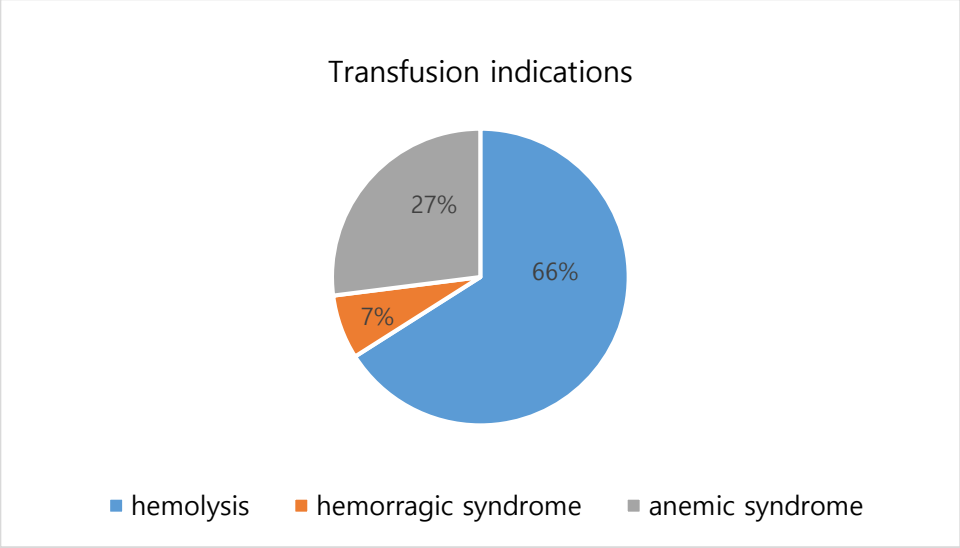

Figure 3: Transfusion indications of red cell blood

The average number of transfusions was 1.95 +/- 1.47 per patient with a maximum of 8 transfusions in a newborn. The majority of newborns (60%) had received a single transfusion, while 21.67% of newborns were transfused twice and 18.33% of newborns were polytransfused (fig.4).

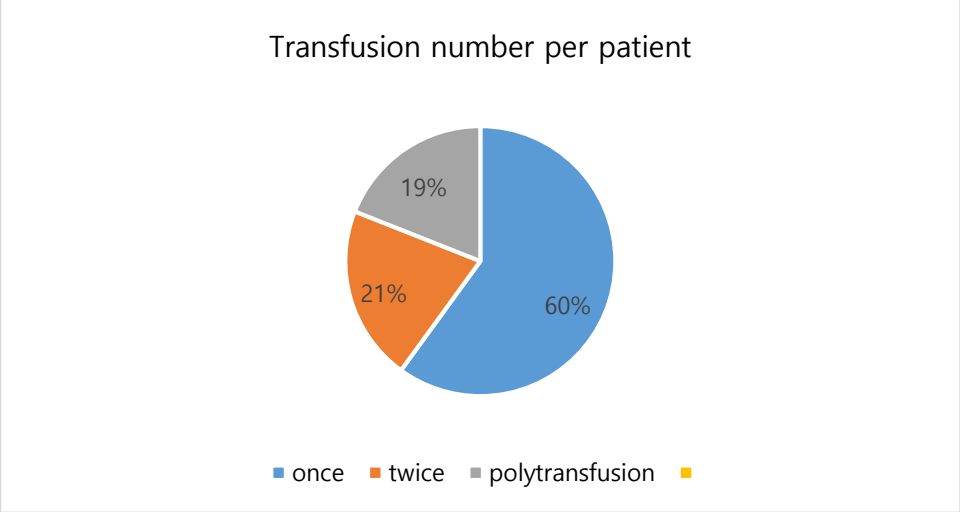

Figure 4: Transfusion number per patient (red cell blood)

There is no statistically significant correlation between the hemoglobin level and the number of transfusions and between the occurrence of hemolytic anemia and the number of RBC transfusions (CI = 95, %, p> 0, 05). The interval between transfusions was 150.86 hrs. +/- 13 hrs.

A single transfusion accident was observed in a newborn transfused for hemolytic anemia: 2 febrile peaks at 39 ° C quickly resolved after stopping the transfusion.

The evolution was favorable in 71.67% of cases with an increase in the hemoglobin level.

4. Discussion

Blood transfusion is frequent in neonatology department; in fact, 50 to 90% of newborn of gestational age less than 32 weeks of gestation or birth weight less than 1500 g were transfused (Afssaps, 2002).

Gestational age is a fundamental epidemiological parameter in the transfusion decision; 88% to 75% of the newborns transfused at Valie-Asr hospital were under 35 weeks of age and 51% of the patients were premature in Tehran (Royon et al., 2012).

The newborn is particularly exposed to the occurrence of anemia which may justify, depending on the case, one or more transfusions of red blood cell concentrates. The mechanisms of these anemias are multiple: immune, depletion (feto-maternal hemorrhage, blood samples) or by lack of regeneration (prematurity, iron deficiency) (New et al., 2016).

The Souilmi and Oulmaati study found the transfused blood product in the majority of cases was RBC (69%), followed by plasma (43%) and platelets (19%) (Souilmi et al., 2015).

The specific transfusion characteristics of this period of life must be known, having an optimal efficiency and minimize the risks inherent in this practice, which obeys very specific rules. The rules for transfusion in the neonatal period are based on specific physiological and immunological bases (New et al., 2016). Indeed, in the newborn and up to the age of 3 months the immunological rules which ensure transfusion safety are different from those applied to the older child and to the adult. Blood transfusions in newborns are mainly indicated for the acute treatment of perinatal or surgical hemorrhagic shock and to "maintain" the correction of recurrent anemia in premature infants. Advances in transfusion medicine, which reduce the exposure and risks of multiple donors, have increased confidence in blood banks (Colombatti et al., 2016). Although preventive methods have proven their effectiveness (limitation of blood samples, delayed cord clamping, iron supplementation, treatment with recombinant erythropoietin [r-HuEPO]. These newborns may require transfusions in red blood cells, sometimes repeatedly (Colombatti et al., 2016).

Simple transfusions, combined with intensive phototherapy to treat hyperbilirubinemia, are currently the most commonly used therapy for the treatment of neonatal hemolytic disease. Quite often it must be renewed during the first weeks of life. The single donor protocol for transfusion in blood cells consists of the allocation to a child of 4 pediatric units from the same blood donation (Dollat et al., 2016). This practice reduces the number of donors to which the child is exposed in order to minimize the risks of infection and allo-immunization. In 2002, the French Agency for the Health Safety of Health Products (Afssaps) recommended using the SDP in the event of multiple transfusions in the newborn (Afssaps, 2002).

The possible presence in the newborn of immune antibodies type IgG and specific anti-D, anti-A, anti-B or others of maternal origin makes transfusion therapy more complex with a risk of dramatic hemolytic accident if red blood cells transfused into the newborn are not compatible with the maternal antibodies (Hautes, 2014).

If in emergency situations the mother and child groups are not known or if in doubt, use rhesus negative blood lacking without anti-A and anti-B antibodies (Hautes, 2014).

Transfusion of red blood cell concentrates can improve tissue oxygenation and treat symptomatic anemia. The fetal hemoglobin will be replaced by adult hemoglobin which improves the tissue release of O2. Concentrates of transfused adult red blood cells deliver better O2 to peripheral tissues due to a shift to the right of the O2 dissociation curve with hemoglobin, a decrease in the consumption of O2 and increased O2 pressures in venous blood (Wibaut et al., 2012).

The implementation of transfusion-saving strategies by reducing blood spoliation, the use of recombinant human erythropoietin, the administration of iron and vitamins and the delayed clamping of the umbilical cord have made it possible to reduce the frequency of transfusions of RBC in the neonatal period, keeping only well-coded indications for this act (Dicky et al., 2016).

About 40% of newborns weighing between 1000 and 1500 g at birth and 90% of those weighing <1000 g can receive an average of five transfusions of red blood cells during their hospitalisation (Natasha, 2017).

The use of a single donor for multiple transfusions in the same newborn baby has two advantages, immunological and infectious (reduction in the number of donors).

The storage of red blood cells in fact leads to an accumulation of bioactive substances and functional changes in erythrocytes which may have clinical consequences (Dollat et al., 2016).

In 2015, the HAS proposed to use only units of less than 28 days in newborns <32 SA or <1500 g or benefiting from a single donor. For the others, it maintained the shelf life at 42 days (Afssaps, 2002).

5. Conclusion

Although transfusion practices have changed in recent years, the neonatal period remains a period where the transfusion of labile blood products (in particular concentrated red blood cells) is frequent, particularly in premature babies with low birth weight.

The various studies on neonatal transfusion show that transfusion practices during the neonatal period are very heterogeneous from one team to another, even within the same team. It is therefore important to know the specific pathophysiological features specific to this age of life in order to reduce the risks of transfusion and allow optimal effectiveness of this therapy.

The number of transfusions in the neonatal period for anemia of prematurity has fallen sharply in recent years. It is the conjunction of the application of strict transfusion recommendations, the reflection of medical practices to limit blood spoliation, the improvement of resuscitation techniques and perinatal care allowing children to have shorter duration of respiratory assistance. The use of a single donor for multiple transfusions in the same newborn baby has two advantages, immunological and infectious (reduction in the number of donors). From his first transfusion, he will have a suitable product with a minimum number of donors.

Conflicts of interest: none
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