Analysis of Transfusion Practices in the Service of Medicine and Neonatal Resuscitation of Rabat, Morocco

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Authors' contributions

This work was carried out in collaboration between all authors. Author BA designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors RMA, KM and AEH managed the literature searches, analyses of the study analysis and author MM managed the experimental process. All authors read and approved the final manuscript.

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ABSTRACT

Blood transfusion is a common practice in neonatal but not without risk as well as immunological and infectious.
The Aim of Study: To determine the prevalence of transfusion, the number of transfusion episodes, age at first transfusion and the main indications for transfusion to critically evaluate our transfusion practice.

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Materials and Methods: This is a prospective and analytical exaustive study conducted at the National Reference Center for Neonatology and Nutrition Children's Hospital of Rabat between July 1, 2011 and July 31, 2014.
Results: A total number of 7000 infants were admitted to the center during this period, 300 of them were transfused one or more times a prevalence of 4.2%; These infants had a gestational age (GA) through 35 weeks of amenorrhea (WA) and 4 days with extremes of 28 and SA 40 WA. 13% of newborns have a gestational age less than 32 weeks and 47% between 32 and 36 WA + 6 days. Their birth weights ranged between 890 g and 4050 g with an average of 2063 g. 36% of infants had a weight of less than 1500 g birth. The total number of transfusion episodes received by newborn, ranged between 1 and 4 transfusions with an average of 2.5±1.2. It was essentially isolated from red blood cells (RBC) transfusions (66% of transfusion acts). Seventy-five percent of cases were transfused in the first week of life. The main indication was anemia associated with infectious haemolysis. The hypoproteinemia with hypoalbuminemia had indicated the contribution of fresh frozen plasma (FFC). Platelet transfusion was required in a case of thrombocytopenia 4000 / mm^3 with hemorrhagic syndrome. No newborn had submitted post-transfusion complications.
Conclusion: In our context, the use of erythrocyte transfusions especially is still very common in the population of preterm infants which prompts us to adopt certain strategies to prevent anemia of prematurity including streamlining of blood samples, the use of micro-methods and optimization of transfusion indications.

1. INTRODUCTION

Blood transfusion is a common practice in neonatology. It is to transfuse blood or one of its cellular components and plasma of one or more subjects called "donors" to one or more sick patients called "recipients". The use of this treatment procedure is common among newborns essentially premature, hence the need for a thorough knowledge of hematological and physiological characteristics specific to the newborn, to ensure maximum efficiency and to minimize the risks inherent in this practice.

The aim of our study was to determine the prevalence, number of transfusions, age at first transfusion and the main indications for transfusion to critically evaluate our transfusion practice.

2. MATERIALS AND METHODS

This is an analytical prospective exhaustive study at the National Reference Center for Neonatology and Nutrition, Children's Hospital of Rabat on a 36-month period from 1 July 2011 to 31 July 2014.

Using a form of exploitation, we collected anthropometric data, particularly gestational age (GA) and birth weight, gender, age at time of admission, the reason hospitalization, diseases presented during hospitalization and length of stay.

Biological parameters (blood count, serum protein, serum albumin, grouping ABO Rh, Coombs test) at admission and at the time of the first blood transfusion were identified.

We estimated iatrogenic losses, by blood samples taken throughout the hospital, through the number of samples retained in the records and taking into account the amounts usually taken from the service for each type of blood test.

We have clarified the clinical and laboratory indications of the first transfusion and the age of its implementation and the total number of transfusions received by newborn during hospitalization, and in the short-term.

The statistical software SPSS Version 18.0 for Windows (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. The level of statistical significance was considered when p <0.05. Continuous data were presented as mean. When data did not obey a normal distribution, data were reported as medians and interquartile in (IQR). A comparison of continuous data was performed using Student's T test. Discrete data were described in frequency and percentage. Comparisons of categorical characteristics were performed by a Chi2 test.

3. RESULTS

3.1 Frequency

During the 36-month study, 300 newborns were transfused on 7000 hospitalized in neonatal center during the study period for a prevalence of 4.2% (Table 1).

3.2 Characteristics of the Study Population

3.2.1 Gestational age

Newborns transfused had an average gestational age of 35 weeks of amenorrhea (WA) and 4 days with extremes of 28 and SA 40 SA. 13% of infants had a gestational age less than 32 weeks, and 60% were preterm (Table 1).

3.2.2 Sex

We noted a male predominance with a ratio of 2.13 (Table 1).

3.2.3 Birth weight

Birth weight (BW) varied between 890 g and 4050 g grams with an average of 2063 g. 36% of infants had a weight of less than or equal to 1500 g birth. Fifty-three percent of patients had low birth weight for gestational age (Table 1).

3.2.4 Age at admission

A median age at admission were 6 hours.

3.2.5 Circumstances of birth

The majority (70%) neonates transfused were from a vaginal delivery (Table 1).

3.2.6 Provenance

Most infants 61.7% were born at the birthing maternity Souissi room, which is a level III maternity (Table 1).

3.2.7 Causes for hospitalisation

The reasons for hospitalization of infants are diverse. In some cases, there was more than one reason per patient (Table 2).

3.3 Practical Transfusion

3.3.1 General data

The distribution of infants according to the blood group showed a predominance of positive A and O groups.

Blood products used were mainly represented by packed red blood cells (RBC) with a percentage of 70% of all transfusion acts (Table3).

[1] The average volume transfused was 46.6±19cc for RCC, 80±40.7cc for fresh frozen plasma FFP and 30cc for platelet pellets PC. No newborn was transfused whole blood. The total number of transfusions received by newborn, was between 1 and 4 transfusions with an average of 2.5±1.2. Two patients had been transfused 4 times.

The majority of transfusions were held in the first week of postnatal age (70%).

3.3.2 Erythrocyte transfusion RBC

Seventy percent of newborns, regardless of gestational age, were transfused packed red blood cells, 75% were in the first week of life (75%).

The main indications for transfusion were dominated by hemolysis and hemorrhage (internal, external, loss by repeated samples) (Table 4).

At the first transfusion, the average transfusion threshold was 9.8±2 g/dl hemoglobin and 28.9% hematocrit. Mean corpuscular volume was 102.5±7.3 fl, and mean corpuscular hemoglobin concentration average of 34.6±1.9g/dl. All newborns had been transfused RBCs group O Rh -. The average volume of blood collected during hospitalization was 18±11.52 ml with a range of 9 and 58 ml.

3.3.3 Platelet transfusion

Platelet transfusion was concerned 2% of newborns. The indication was deep peripheral thrombocytopenia 4,000/mm³ secondary to severe sepsis and DIC.

3.3.4 Transfusion of fresh frozen plasma (FFP)

Twenty-eight percent of patients had received FFC. Transfusion indications were represented by hypo-protidemia with hypoalbuminemia in 20% of cases, disseminated intravascular coagulation DIC in 5.5% of cases and dyscrasias in 2.3% of cases.

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[1] *RBC : Red blood cells*
FFP : Fresh Frozen Plasma
PC : Platelet pellets
TB : Total Blood

Table 1. General description of the study population (columns reversed)

Parameter	Prevalece	Gestationnel age (GA)		Delivery		Sex		Weight of birth		Trophicity		Apgar 5'		Provenance	
		< 37 SA	< 28 SA	Vaginal	Caesarean	Female	Male	≤1500 g	> 1500 g	Eutrophic	Hypotrophic	<7/10	>7/10	Rabat	Others
Percentage	4,2%	60%	13%	30%	70%	32%	68%	33%	67%	53%	47%	28%	78%	63%	37%
Number	Total= 300	180	39	90	210	96	204	102	198	159	141	34	216	189	111

Table 2. Main reasons for admission

Pathology	Number of cases
Infection	200
Respiratory distress	30
Icterus	20
Hemorrhagic syndrome	10
Surgical Pathology	10
Neonatal pain	10
Isolated prematurity	20

Table 3. Frequency of blood products transfused

Nature of the product	Percentage %
RBC	70
FFP	28
PC	2
TB	0

Table 4. Indications for RBC transfusions in the first week of postnatal age

Indication	Number of cases
Bleeding from various causes	160
ABO and Rh incompatibility	20
Isolated anemia	30
Inadequate weight and anemia	30

3.3.5 Evolution

No complications related to transfusion was reported in our series.

4. DISCUSSION

4.1 Epidemiology

Blood transfusion is a common practice in neonatology. The very preterm (less than 28 weeks of gestation) or low birth weight (less than 1500 g) represent a population at high risk of transfusion [1].

Despite the different progress of this therapy in recent years, large discrepancies persist in transfusion practices.

Regarding the incidence of transfusions, our study shows a 6% rate of transfusion acts in preterm and term neonates with a mean number of 2.5±1.2 transfusions (far from January to April). This figure is down from previous years. Between 1997-2000, the frequency of newborns transfused of all admissions to neonatal unit alone was 39.7% [2].

This drop in transfusion requirements, observed both nationally and internationally, is mainly due to a combination of the application of strict recommendations of transfusion, thinking medical practices to limit blood loss, the improved resuscitation and perinatal care with the application of a blood saving strategy [1,3].

In our series, 13% of neonates transfused had a gestational age less than 32 weeks and 36% weighed less than 1500 g. According to Strauss, 70-80% of infants with birth weight <1500 g were transfused with an average of ten transfusions per child. Approximately 50% of preterm gestational age less than 32 weeks gestation and/or weighing less than 1500 grams birth were transfused at least once during their term of neonatal hospitalization, while 90% of premature infants younger 1000 grams would receive multiple transfusions [4-10]. This difference is more due to the fact that our unit supports newborns of gestational age greater than 28SA.

4.2 Red Blood Cell Transfusion (RBC)

Erythrocyte transfusion represents the major fraction of labile blood product transfusions. The main objective including the neonatal period is to improve tissue oxygenation and fight against the clinical implications of anemia. Indeed, a recent survey service showed that 8.8% of infants hospitalized in neonatal intensive care and neonatal blood cells are transfused at least once.

In our series, we noted 140 cesarean deliveries, 20 for placenta previa and 5 for cord prolapse. It also noted five cases from twin pregnancies and who have presented twin-twin transfusion syndrome. A postnatal hemorrhage was observed in 160 cases in our study.

An early anemia due to excessive hemolysis Immunological by ABO or Rh incompatibility infection, and Central by bone marrow's injury was detected in 20 cases.

The blood loss secondary to removal iterative widely implicated in the occurrence of anemia of prematurity [1]. It is particularly important that the premature gestation is low, low birth weight or sick. Techniques "rapid test" seem an effective way to fight against neonatal anemia by blood loss. Belatedly, the premature newborn may have a secondary iron deficiency anemia from the second month of postnatal age.

In our series, the average volume collected throughout hospitalization was approximately 18±11.52 ml with a range of 9 and 58 ml. This represents approximately 10-30% of the total blood volume and correlates, in transfused blood volume [4,11]. This relatively low rate compared to other series including that of Obladen, where attrition rates ranged from 24 cc/kg for healthy preterm infants and 67 cc/kg for sick prematures [12], that could be explained by the fact we do not yet have precise quantification techniques neonatal blood loss, and because the notification of all samples was not efficient in all cases.

Seventy percent of infants had received their transfusion during the first two weeks. Most authors report that half of BC transfusions for premature low birth weight occur during the first two weeks of life, a period in which they are most often unstable hemodynamically and require biological samples repeatedly [13,14], hence the need to minimize these samples, using micro-methods and to focus on non-invasive means of monitoring in these infants [1,3,15].

In France, the number of transfusion episodes decreased from 3.6 in 1995 to 1.7 in 1998 [16]. This reduction was noted in several developed countries. It is mainly due to the introduction of

erythropoietin as a preventative and curative treatment of neonatal anemia. In our series, the average number of transfusion episodes was 2.5±1.2 with extreme episodes from January to April. Other studies [14] reported that the rate is 3.3 to 4.9 transfusions newborn. The difference is explained by several factors: lower gestational age at 30 WA, birth weight less than 1000 g, duration of mechanical ventilation and severity of neonatal disease [13,14].

Moreover, no validated consensus for preterm's transfusion of BC exists to this day. In current practice, RBC transfusions are useful if the hemoglobin level is below 13 g/ 100 ml for the first 3 days of life in severe respiratory distress [1]. Subsequently three parameters guide the indication: the hemoglobin (Hb) correlated with clinical situation, gestational age (GA) and associated morbidities [1,7].

The transfusion volume varies between 10 and 20cc teams/kg [1,14,17]. However, several studies have shown that the volume of 20 cc/kg is more effective than a volume of 10 or 15 cc/kg in terms of increase in hemoglobin, reducing the number of transfusions and making best the neurodevelopmental developement.

The red blood cells transfused must be compatible with the group of the child and the mother's antibodies. If a single determination ABO-Rh is available in children, it is recommended to use concentrated group O Rh negative. It is imperative that the red blood cells used are CMV negative if gestational age is less than 32 weeks unless the mother is positive CMV. These should be recorded if the search is irregular agglutinin positive in the mother or the child, if irradiated exchange transfusion or massive transfusion. The use of pediatric units from a single donor is preferred if indications of iterative transfusions are predictable.

All patients had received RBC group O Rh negative phenotyped, leukocyte-depleted and irradiated.

The patients studied had been transfused for medium levels of hemoglobin (Hb) of 9.8±2 g/dl (range 3.5a 14.7 g/dl) and hematocrit (Ht) of 28.9±6.3% (range 10.4 to 47.4%). These thresholds are close to those recommended in the literature.

A systematic review and meta-analysis of 15 controlled trials concluded that the clamping over

two minutes after birth increases the rate of ferritin and reduces the risk of anemia increases with polycythemia. La cochrane on the same subject included 11 trials involving 2989 children, found an increase in hemoglobin and ferritin in the late clamping group. This is a protocol that is setting up in Morocco [18,19].

4.3 FFP Transfusion

Transfusion of fresh frozen plasma in the new-born is only indicated in the presence of acute hemorrhage, surgical or medical procedure in high-risk with profound hemorrhagic haemostatic anomaly. It may be recommended when rare clotting factor deficiencies complex, where the specific fractions coagulant is not available [1,20]. Volume infused is usually from 10 to 15 mL/kg for a period of one hour infusion. Consider a sodium intake significant about 1.70 mmol/ 10 mL.

The frozen fresh plasma transfusion must be compatible with the ABO group of the child, or consider, anti-A or anti-B they bring. If a single determination ABO-Rh is available in children, fresh frozen plasma group AB will be preferred. Transfusion should be performed within six hours after thawing and bags must be stored between +2 and +8ºC [1,20]. Transfusion effectiveness is judged on the bleeding stops and the improved balance of crushes.

4.4 Platelet Transfusion

The frequency of thrombocytopenia in neonates is difficult to assess. The previously published results show an incidence of 20-40% in neonates hospitalized in the intensive care unit at any ages. Severe thrombocytopenia <50,000/mm3 exists in 3% of cases between day 0 and day 3 [21].

The aim of platelet transfusion in neonates is to avoid intracranial hemorrhage. It's is prophylactic or curative alternative depending on the severity of thrombocytopenia, the importance of haemorrhagic signs and clinical context [1,22].

The Indications for platelet transfusion in the neonatal period are relatively well codified. As soon as it is an immune-mediated thrombocytopenia and / or accompanying clinical signs of bleeding, administration of platelet is indicated. Against by the use of platelet transfusion is more controversial in moderate

thrombocytopenia premature newborn with severe disease [22].

In our series, the use of platelet transfusions is rare, six infants were transfused packed red platelets for severe thrombocytopenia with hemorrhagic syndrome. Transfusion efficiency is usually objectified by an increase in platelet count with bleeding stops.

5. CONCLUSION

In our context, the use of blood cell transfusions is still very common, as compared to other transfusion products in the population of preterm infants including those of GA than 32 weeks.

This prompts us to reevaluate our practice and try to establish our own valid neonatology center protocol.

Some prevention strategies against the occurrence of anemia in premature infants seem particularly necessary in order to reduce the risk and number of transfusion episodes: Streamlining blood samples, the use of micro-methods, routine iron supplementation and folic acid food and delayed clamping of the umbilical cord at birth room recombinant erythropoietin use.

Finally a transfusion should be noted on the health record of the newborn as he left the center, it will allow caregivers to perform the transfusion post follow-up with parents.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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