

Neonatal Anemia in Two Pediatric Reference Centers in Dakar (Senegal)

Djibril Boiro^{1*}, Idrissa Basse², Laeticia Béatrice Takam², Ndeye Fatou Sow³, Amadou Sow¹, Aliou Abdoulaye Ndongo¹, Aminata Mbaye⁴, Ndiogou Seck⁵, Abou Ba³, Modou Guéye¹

¹Abass Ndao Hospital Center, Dakar, Senegal
²Diamniadio Children's Hospital, Dakar, Senegal
³Dalal Diam Hospital, Dakar, Senegal
⁴Albert Royer Children's Hospital, Dakar, Senegal
⁵Regional Hospital Center of St Louis, Dakar, Senegal
Email: *djibrilboiro@yahoo.fr, *djibril.boiro@ucad.edu.sn

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Abstract

Introduction: The exact definition of neonatal anemia varies between authors and sample sites. The objective was to describe the epidemiological, diagnostic, therapeutic, and progressive characteristics of neonatal anemia. Methodology: This was a retrospective and descriptive study over a 16-month period from January 2023 to April 2024. Any newborn aged between 0 and 28 days of life, regardless of the term at birth, with a hemoglobin level below 14 g/dl was included. Our study was carried out in two pediatric departments: the Abass Ndao Hospital Center (CHAN) and the Dalal National Hospital Center Jamm (CHNDJ). Results: A total of 308 cases were collected. The hospitalization rate was 15.4%. The sex ratio (M/F) was 0.7. Pregnancy-induced hypertension/preeclampsia (10.4%), and anemia in the first trimester (9.4%), were the main pathologies of pregnancy. Preventive iron intake was effective in all mothers. 21 mothers (6.81%) had received a blood transfusion. The notion of anemia in siblings was found in 15 newborns, or 4.9%. Prematurity was 37.3%. More than half of the newborns were delivered vaginally. Retroplacental hematoma was the most common adnexal pathology found at 7.8%. Mucocutaneous pallor was found in 56.5% of patients. Hemorrhage was the most common cause, at 31.8%. For the newborns, 46.5% received a blood transfusion. The death rate was 12%. Premature babies accounted for 33% of deaths. Septic shock was the most common cause of death. Conclusion: Neonatal anemia is common in our setting with a high mortality rate. It is important to strengthen preventive strategies against maternal anemia, infection and adnexal hemorrhages.

Keywords

Anemia, Newborn, Morbidity, Mortality

1. Introduction

The WHO defines neonatal anemia as any reduction in hemoglobin level < 14 g/dl [1].

The prevalence of anemia in newborns varies and its prevalence rate ranges from 10% to 60%; being the highest range led by African countries. Anemia in the newborn period is unique to other age groups that, in addition to the above mechanisms, hemorrhagic/hemolytic conditions, gestational age-dependent variation of hemoglobin, and transition period to extrauterine life contributed to neonatal anemia [2].

The symptomatology depends on the severity of the anemia and its speed of onset. It alters the general condition of the newborn and can be life-threatening, leading to heart failure and cardiovascular collapse. The functional prognosis can also be affected by neurological damage and, in the long term, it can lead to slowed growth [3].

Causes are generally classified into three main groups: hemorrhage, hemolysis, and centrally located anemia. Depending on the severity of anemia and its cause, treatment may involve transfusion, nutritional supplementation, or treatment of causative disease. The indication for transfusion depends on the rapid onset of anemia and gestational age [4] [5].

In Senegal, the last data found concerning neonatal anemia dates back to 2001, when Camara A. *et al.* reported a prevalence of 56.8% [6].

The poverty of these recent data, as a whole, motivated the realization of this study. The principal objective of our study was to determine the epidemiological, diagnostic, therapeutic and evolutionary characteristics of neonatal anemia in our context.

2. Materials and Methods

Our study was carried out in two pediatric departments: the Abass Ndao Hospital Center (CHAN) and the Dalal National Hospital Center Jamm (CHNDJ).

This was a retrospective and descriptive study over a 16-month period from January 2023 to April 2024.

Any newborn aged between 0 and 28 days of life, regardless of the term at birth, with a hemoglobin level below 14 g/dl, and hospitalized in both departments was included.

Not included in this study were newborns admitted whose records were damaged or lost, making it impossible to use the data.

Data collection was carried out from hospital records, follow-up records, and hospital registers using a survey form.

For each newborn, we were interested in the following data:

- Assessment during pregnancy: Hemoglobin in the first trimester: anemia in pregnant women is defined by a hemoglobin level below 11 g/dl in the first trimester according to the WHO.
- The presence of an adnexal anomaly: placenta praevia, retroplacental hematoma (RPH), circular cord, calcified placenta.
- Neonatal anemia: when the Hb level is less than 14 g/dl according to the WHO.
- The early neonatal period was considered for newborns aged 0 to 7 days, and the late neonatal period for those aged 8 to 28 days.

The data entry was done after coding on an Epi info version 7 and excel 2021 model. The exploitation and analysis of the data were carried out using Epi Info version 7 software and SPSS version 21. The analytical study was carried out with a significance threshold for a p-value (p) less than 0.05.

3. Results

2696 newborns were hospitalized, including 1696 at the CHAN and 1000 at the CHNDJ. 2001 newborns had at least one blood count and a complete file (**Figure 1**). 308 newborns had a hemoglobin level below 14g/dl, giving a hospital frequency of neonatal anemia of 15.40%.



Figure 1. Flochart of patients included in the study.

The mean age of newborns at admission was 2.1 days with a standard deviation of approximately 4.3. 90.30% or 278 of the newborns were hospitalized in the early neonatal period. 56.5% or 174 newborns were female.

The mean age of the mothers was 29.06 years with a standard deviation of 6.94 and extremes of 16 and 45 years. The median was 29 years.

High blood pressure (HBP) was the most common maternal antecedent, found

in 41 mothers, or 13.3%. Diabetes and sickle cell disease were also found in 10.7% and 3.9%, respectively.

The mean gesture was 2.3 with a standard deviation of 1.4 and extremes of 1 and 9 gestures. The mean parity was 2.2 with a standard deviation of 1.3 and extremes of 1 and 8 pares.

A total of 133 mothers (43.2%) presented pathologies during pregnancy. Pregnancy-induced hypertension/preeclampsia (10.4%), and anemia in the first trimester (9.4%), were the main pathologies of pregnancy (**Table 1**).

Preventive iron intake was effective in all mothers. 21 mothers, or 6.81%, had received a blood transfusion. The notion of anemia in siblings was found in 15 newborns, or 4.9%.

Pathologies	Effective $(n = 308)$	Percentage (%)
Maternal anemia	29	9.4
Urogenital infection	21	6.8
Pregnancy-induced hypertension/preeclampsia	32	10.4
Gestational diabetes	23	7.5
Cervical incompetence	4	1.3
PRM greater than 12 h	17	5.5
Others (malaria, metrorrhagia in the 3 rd trimester)	7	2.3
None	175	56.8

Table 1. Maternal pathologies during pregnancy.

*PRM: premature rupture of membranes.

Delivery was at term at 57.14%. Prematurity was 37.3% or n = 115. 57.8% of parturients or n = 178 had given birth vaginally.

Retroplacental hematoma was the most common adnexal pathology found in 24 mothers with 7.8% followed by placenta previa (5.8% n = 18) (Table 2).

The majority of newborns had a normal birth weight between 2500 and 3999 at 54.2%. Low birth weights were at 45.8%.

Cephalohematoma, serosanguinous hump and subgaleal hematoma were the most common hemorrhagic abnormalities found, respectively, with 4.5%, 4.2% and 2.9%. Skin pallor was found in 56.5% or 174. In addition, jaundice was found in 71 newborns or 23.1%. The most common clinical abnormalities were respiratory distress (n = 86 or 27.9%), hypotonia at 17.5% and absence of archaic reflexes at 12.6%. Hemorrhage was found in 14 newborns in the form of hematuria and rectal hemorrhage (**Table 3**).

Hb level was 10.8 g/dl with a median of 11.3 and extremes of 1.8 and 13.1. It was significant (less than 10 g/dl) in 52 newborns or 16.8% and severe (less than 7 g/dl) in 9 newborns or 3%. 59% of mothers with blood group O had newborns with blood group A or B. 49 mothers were rhesus negative. Among these 49 moth-

ers, 23 mothers had rhesus positive newborns or 46.9%. 1.9% of newborns had a positive Coombs test. CRP was positive in 77 newborns or 24.9%. Hyperbiluribinemia was found in 72 newborns with a free predominance at 20.45% or 63 cases.

		Effective (n = 308)	Percentage (%)
	<27 weeks + 6 days	12	3.9
	28 weeks and 31 weeks + 6 days	37	12
Gestational age	32 weeks and 36 weeks + 6 days	66	21.4
	37 weeks and 41 weeks + 6 days	176	57.1
	>42 weeks	17	5.6
	Retroplacental hematoma	24	7.8
	Placenta previa	18	5.8
Adnexal pathologies	Prolapse of the cord	4	1.3
	Calcified placenta	2	0.7
	None	260	84.4

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Table 3. Clinical characteristics of newborns.

	Clinical signs	Effective $(n = 308)$	Percentage (%)
	Bruises	3	1
Skin hemorrhages	Petechiae	1	0.3
	Skin bleeding	1	0.3
	Serosanguineous bump	13	4.2
Crane Examination	Cephalhematoma	14	4.6
	Subgaleal hematoma	9	2.9
	Bulging fontanelle	5	1.6
	Pallor	174	56.5
Skin coloring	Jaundice	71	23.1
	Cyanosis	4	1.3

The most common etiologies were hemorrhages (n = 98 or 31.8%), and infections (n = 82 or 26.6%). Among the hemorrhages, intrapartum hemorrhages were the most numerous with 42 cases or 42.8% of the hemorrhages. Hemolysis represented 20.5% of the anemias, the cause of which was undetermined at 25.4% (Table 4).

A total of 144 newborns (46.50%) had received a transfusion. The mean time to

obtain blood was 1.8 days, with a standard deviation of 1.1, a median of 1 and extremes of 1 and 5 days. More than half received the transfusion within 48 hours of life (74.31%). 42 newborns were supplemented with iron, *i.e.*, 13.50% (Figure 2).

Etiologies	Effective $(n = 308)$	Percentage (%)
Hemorrhage	98	31.8
Prenatal (TP)	23	23.5
Perinatal (PP, RPH)	42	42.8
Postnatal	33	33.7
Hemolysis	63	20.5
ABO incompatibility	24	38.1
Rh incompatibility	23	36.5
Indeterminate	16	25.4
Infection	82	26.6
Indeterminate	65	21.1

Table 4. Distribution of neonatal anemia by cause.

^{*}TP: twin pregnancy; *PP: placenta previa; *RPH: retro-placental hematoma.



Figure 2. Distribution according to treatment received.

The mean length of hospitalization was 7.86 days with a standard deviation of 5.64 and extremes of 1 and 31 days. The median was 6 days. More than 3/4 of the newborns (85.1%) had progressed well. 14.9% of the newborns had presented complications either related to anemia or its cause (**Table 5**).

We recorded 37 cases of death (12%). The mean age at death was 6.06 days with a standard deviation of 6.86. Extremely premature infants recorded the highest number of deaths in 12 cases (33.33%). Septic shock was the most common cause of death at 4.5%.

Complications	Effective	Percentage (%)
Septic shock	16	5.2
Hypovolemic shock	5	1.6
Lightning haemorrhage	4	1.3
Seizures	5	1.6
Nuclear jaundice	2	0.6
Kidney failure	2	0.6
Respiratory failure	4	1.3
Coma	3	1
Metabolic disorders	5	1.6

Table 5. Distribution according to complications.

4. Discussion

Limitations of the study: As this was a retrospective study, the major difficulties we encountered were mainly linked to data processing, due to the generally short duration of hospitalization and the missing data at the time of collection. This could lead to biases, which we have taken into account to interpret the results better.

The frequency of neonatal anemia was 15.40%. This frequency was lower than those found in the literature with 57.2% in Cameroon in 2014 [7], 26.8% in Afghanistan in 2023 [8] and 23.2% in Ethiopia in 2022 [9]. This difference could be attributed to differences in the characteristics of the study population and the sample size. Furthermore, it was similar to the data found in Uganda with 17% [10] in 2021.

Maternal anemia was found in 9.4% of mothers during pregnancy. This was lower than the data of Dereje I. *et al.* with 24.1% [11] of anemic mothers and Alamneh *et al.* with 94.1% [9]. Anemia during pregnancy could be linked to an iron deficiency that can be secondarily responsible for anemia in the newborn. The WHO recommends iron supplementation during pregnancy, as it is carried out in all our parturients.

Prematurity was 37.41% in our study. These data were consistent with those in the literature where Mansoor A. *et al.* found 32.2% [8] and Almaneh T. *et al.* in 2021 found 43% of premature babies [9]. Anemia in premature newborns is common. It is linked to the immaturity of hematopoiesis and a predisposition to multiple pathologies that require repeated sampling responsible for blood loss [12].

More than half of the parturients had given birth vaginally (57.8%). The same was true in Afghanistan with 59.9% [8]. In the study by Dereje I. *et al.*, the frequency of vaginal delivery was higher at 82% [11]. Anemia was associated with cesarean birth. Some studies also reported cesarean section as a risk factor for neonatal anemia. This was explained by the risk of significant hemorrhage during cesarean deliveries due to uterine atony [10].

The main clinical signs were mucocutaneous pallor (56.5%) and jaundice (23.1%).

Integumentary pallor is a subjective sign that depends on the observer's judgment. Studies conducted by the WHO in several countries have shown low sensitivity to the degree of conjunctival pallor: 62% of anemias are not detected by the naked eye. However, when anemia is significant (Hb level < 10 g/dl) sensitivity is better. Pallor could also be masked by jaundice.

The mean hemoglobin was 10.8 ± 1.62 g/dl in our study. This is different from the study of de Dianiele K. K. *et al.* with a mean of 13.4 g/dl [7].

Anemia was significant (<10 g/dl) in 16.8% of newborns.

Infection and hemorrhage were the most common causes in our study. Hemorrhages are involved in 5% to 10% of severe neonatal anemias and 25% of present anemias in newborns hospitalized in neonatology units. It has been shown that across all pregnancies, 20% are ABO incompatible [13]. Indeed, newborns from Rh-negative mothers and blood group O have a higher risk of having neonatal jaundice due to IMF in the Rh system and the system. In our series, the risk of ABO incompatibility represented 38.10% of hemolytic anemias. Furthermore, 25.40% of hemolytic anemias were indeterminate, a figure different from the results of Mutumbo (9.2%) [14]. Progress in diagnosis is still low in our countries.

The average time to obtain blood was 1.8 days, with a standard deviation of 1.1. More than half received the transfusion within 48 hours of life (74.31%). The unavailability of blood products 24/7 remains a problem in our facilities.

Overall, neonatal anemia treated in a timely manner progresses well with return home without sequelae or subsequent complications. Indeed, in our study, more than $\frac{3}{4}$ of newborns (85.1%) had a favorable evolution. However, complications remain problematic. Septic shock and respiratory failure were found in 4.5% and 1.3% of cases respectively. The severity of anemia is also linked to the underlying pathology. The average length of hospitalization was 7.86 days \pm 5.6, similar to the average length of hospitalization which was 9 days \pm 6.2 in the study by Daniele K. K. *et al.* [7].

Furthermore, we recorded 37 cases of death (12%). Very premature babies recorded the highest number of deaths at 12 cases (33.33%). Septic shock was the most common cause of death at 4.2%.

5. Conclusion

Neonatal anemia is common in our context with a high mortality rate. Diagnosis and management are sometimes difficult. The main causes found included maternal anemia, maternal antepartum hemorrhage, septicemia in the newborn, and prematurity. It is important to strengthen preventive strategies by providing more training for medical staff and raising pregnant women's awareness of preventable causes of maternal anemia, infection and adnexal hemorrhages.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] World Health Organization (2004) Fact Sheet for National Blood Transfusion Programmes.
- [2] Tilahun, D., Yimer, M.A. and Zamanuel, T.G. (2022) High Magnitude of Neonatal Anemia among Sick Newborns Admitted to University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia. *Journal of Blood Medicine*, 13, 293-302. https://doi.org/10.2147/jbm.s361675
- [3] Tasseau, A. and Rigourd, V. (2004) Anémie néonatale précoce: Orientation diagnostique. *Journal de Pédiatrie et de Puériculture*, 17, 198-203. https://doi.org/10.1016/j.jpp.2004.04.008
- Bonastre-Blanco, E., Thió-Lluch, M. and Monfort-Carretero, L. (2010) Anemia Neonatal. *Anales de Pediatría Continuada*, 8, 73-80. <u>https://doi.org/10.1016/s1696-2818(10)70013-5</u>
- [5] Kuissi Kamgaing, E., Minto'o Rogombe, S., *et al.* (2018) Aspects épidemiologiques et thérapeutiques de l'anémie néonatale au centre hospital-universitaire d'Angondje-Gabon. *Journal of the Society of Clinical Biology of Benin*, No. 28, 52-59.
- [6] Camara, A., Diallo, S., *et al.* (2002) Anemia in the Newborn: Frequency and Etiology. *Institute of Child Nutrition and Health (INSE) Medicine of Black Africa*, 49, 136-137.
- [7] Daniele, K., Noel, E., *et al.* (2018) Epidemiological, Clinical, Biological and Evolutionary Profile of Neonatal Anemia at the Bonassama District Hospital. *Health Science and Disease*, **19**, 11-14.
- [8] Mansoor, A., Yazdan, D., et al. (2024) Evaluation of the Factors Associated with Anemia in Neonates Admitted to the Neonatal Unit of Maiwand Teaching Hospital: A Cross-Sectional Study. Global Pediatric, 8, Article 100164.
- [9] Alamneh, T.T., Tilahun, S.F., Beyne, M.B., Fekadu, S.A., Assem, A.S. and Kassa, S.F. (2022) Prevalence and Associated Factors of Anemia among Newborns at Tibebe Ghion Specialized Hospital, Northwest Ethiopia. *International Journal of General Medicine*, 15, 6465-6474. <u>https://doi.org/10.2147/ijgm.s365817</u>
- [10] Ngonzi, J., Tibaijuka, L., et al. (2023) Prevalence and Risk Factors for Newborn Anemia in Southwestern Uganda: A Prospective Cohort Study. This Is a Preprint. <u>https://doi.org/10.21203/rs.3.rs-3054549/v1</u>
- [11] Dereje, I., Etefa, T., Gebremariam, T., Getaye, A., Tunta, A. and Gerbi, A. (2021) Prevalence of Anemia and Associated Factors among Term Newborns in Nekemte Specialized Hospital, Western Ethiopia. *Journal of Multidisciplinary Healthcare*, 14, 2607-2615. <u>https://doi.org/10.2147/jmdh.s326962</u>
- Kollamparambil, T.G., Carroll, W. and Kuttiyat Rayaroth, D. (2024) Neonatal Anaemia. *Paediatrics and Child Health*, **34**, 154-159. https://doi.org/10.1016/j.paed.2024.02.007
- [13] Wirthner, D., Hohlfeld, P., *et al.* (1998) Perinatal Hemolytic Disease. Part 1: Physiopathology. *Journal de Gynécologie, Obstétrique et Biologie de la Reproduction*, 27, 135-143.
- [14] Mutombo, A.K., Mukuku, O., Kabulo, B.K., Mutombo, A.M., Ngeleka, A.M., Mutombo, J.D., *et al.* (2014) Ictères pathologiques du nouveau-né à l'hôpital bonzola de mbuji-mayi, république démocratique du congo. *Pan African Medical Journal*, 19, Article 302. <u>https://doi.org/10.11604/pamj.2014.19.302.5658</u>