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Outcome in Newborns of Mothers with Sickle Cell Disease in Ouagadougou, Burkina Faso: A Retrospective Study from 2019 to 2023

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Abstract

Sickle cell disease affects 5% to 10% of the population in Burkina Faso. There has been remarkable progress in reducing mortality associated with this condition. However, survival in pregnant women with sickle cell disease is still a challenge. Moreover, little is known of the outcome of their children in the early moment of life. A retrospective study was conducted from January 1, 2019 to December 31, 2023. Newborns born at Yalgado Ouedraogo hospital's maternity whose mothers had a major sickle cell syndrome were included. A bivariate and multivariate analysis was used to determine factors associated with newborn deaths (P-value ≤ 5%). A total of 656 newborns were included, with an annual frequency of 141. Mothers' mean age was 26 years, 91% had hemoglobin SC and 21% had vaso-occlusive crisis at admission in the maternity ward. Newborns were males in 51%, and the mean birth weight of newborns was 2705 g [extremes 845 and 4700 g]. In multivariate analysis, factors significantly associated with neonatal deaths were maternal vaso-occlusive crisis on admission (OR = 3.39; P-value = 0.032), low birth weight (P-value = 0.027), acute respiratory distress (P-value = 0.011) and prematurity (P-value = 0.018) in newborns.

Keywords

Sickle Cell, Mother, Newborn, Ouagadougou

1. Introduction

Sickle cell disease is an autosomal recessive inherited genetic disorder, characterized by the presence of abnormal hemoglobin S [1]. It is the most common genetic

disease in the world and a major public health problem [2]-[4]. Worldwide, more than 300,000 newborns are born each year with hemoglobin SS and 75% of them are in Africa [5]-[9].

Pregnancy can influence sickle cell disease with constant anemia and frequent vaso-occlusive crisis, which can be life-threatening for the fetus [10]-[12]. Labor is often perilous with intense pain and severe metabolic disorders [12] [13], resulting in an increased risk of miscarriage, premature birth and neonatal death [11].

In Burkina Faso, sickle cell disease affects 5% - 10% of the population [14]. Although much has been accomplished to improve the survival in patients with this blood disorder, labor and post-partum periods are still very risky in resource-limited setting, due to inadequate care of mothers and newborns. Moreover, scarcity of universal post-natal follow-up for newborns of mothers with sickle cell disease results in inconsistent data on their outcome and in turn insufficient political willingness to change practices.

2. Material and Methods

The study setting was the maternity and pediatric wards at the Yalgado Ouedraogo hospital in Ouagadougou, Burkina Faso, which is the largest referral hospital in the country. A retrospective data collection was conducted. The study population consisted of newborns whose mothers were carriers of a major sickle cell syndrome hemoglobin born from January 1, 2019 to December 31, 2023. We defined a major sickle cell syndrome as inheritance of a sickle cell gene from each parent (phenotype SS) or with another abnormal hemoglobin gene (phenotypes SC, Sβ). All live-born newborns were included. Data on socio-demographic and clinical characteristics, as well as the outcome of newborns in the first seven days of life, were collected. Medical records were used as collection tools. Anemia during labor was defined as a hemoglobin level < 11 g/dl and in newborns < 14 g/dl.

Chi-square test was used to compare qualitative variables and a logistic regression model step by step was used to determine factors significantly associated with neonatal deaths in newborns who had follow-up data available, for the first 7 days of life. Variables with the p-value < 20% in the univariable model were introduced in a multiple variable model for the final model. In the final model, factors with P-value < 5% were considered significantly associated with mortality.

3. Results

3.1. Characteristics of the Population

We included 656 newborns. Mothers' mean age was 26.3 years ± 5.8 [extremes 15 and 44 years], with 93% of them aged less than 35 years. Maternal hemoglobin phenotype was SC (90.7%), SS (8.5%) or Sβ thalassemia (0.8%). The main reason for admission at the maternity unit was a vaso-occlusive crisis in 21% of mothers (**Table 1**). Hypertension and fever were present in 20.9% and 18.1% of them, respectively. Anemia was present in 558 (87.4%) mothers, with 9% presenting severe anemia. Boys accounted for 51% of the newborns.

Table 1. Causes of admission of newborns' mothers with sickle cell disease at Yalgado Ouédraogo maternity ward from January 1, 2019 to December 30, 2023 (n = 638).

Motifs of admission	n	%
Maternal affections	**276**	**43.3**
Vaso-occlusive crisis	*137*	*21.5*
Anemia	*63*	*9.9*
Vasculo-renal syndrome	*33*	*5.2*
Severe malaria	*11*	*1.7*
Retinopathy	*6*	*0.9*
Labor	**198**	**31**
Ovulary complications	**144**	**22.6**
Labor dystocia	*32*	*5*
Fetus asphyxia	*30*	*4.7*
Vicious presentation? Breech presentation	*16*	*2.5*
Abnormal amniotic fluid	*15*	*2.4*
In utero fetal death	*14*	*2.2*
Threatened preterm labor	*10*	*1.6*
Post term	*9*	*1.4*
Macrosomia	*6*	*0.9*
Prophylactic cesarean section	**61**	**9.6**
Twin pregnancy	**26**	**4.1**
Labor dystocia	**17**	**2.7**

3.2. Newborn Outcome and Factors Associated with Mortality

The mean birth weight was 2705 g [extremes 845 and 4700 g], with 21% born with low birth weight. About half of newborns (57.8%) had health issues in the first hours of life, as shown in Table 2 and were admitted to the pediatric unit.

Table 2. Indications for cesarian section in newborns' mothers with sickle cell disease at CHU YO from January 1, 2019 to December 30, 2023 (n = 351).

Indications	n	%
Scarred uterus	137	39
Vaso-occlusive crisis	114	32.5
Fetal distress	55	15.7
Mechanical dystocia	47	13.4
Mother's disease?	46	13.1
Multiple pregnancy	39	11.1
Dynamic dystocia	12	3.1
Intrauterine growth retardation	10	2.9
Premature rupture of membranes	10	2.9

Twenty-four (3.7%) newborns died the first seven days of life of whom 14 during hospitalization and 10 at home.

Data on follow-up care for the first 7 days were available for 328 newborns.

In the univariate and multivariate analysis (Table 3), the factors significantly associated with neonatal death were: maternal vaso-occlusive crisis on admission (OR = 3.39; P-value = 0.032), low birth weight (OR = 14; P-value = 0.027), acute respiratory distress in newborns (OR = 12.6; P-value = 0.011) and prematurity (OR = 5; P-value = 0.018).

Table 3. Diagnosis of newborns of mothers with sickle cell disease at Yalgado Ouedraogo hospital from January 1, 2019 to December 31, 2023 (n = 656).

	n	%
Characteristics at birth		
Prematurity	*139*	*21.2*
Post term	*15*	*2.3*
Hypotrophy [500 - 2500 g]	*182*	*27.8*
Macrosomia (≥4000 g)	*10*	*1.5*
Perinatal asphyxia	*97*	**14.8**
Causes for transfer to pediatric ward (n = 140)		
Low birth weight	75	53.6
Respiratory distress	45	32.1
Prematurity	40	28.6
Acute fetal distress	21	15.0
Fiver	6	4.3
Breastfeeding problems	5	3.5
Neurological disorders? Which ones	4	2.9
Macrosomia	4	2.9
Jaundice	2	1.5
***Diagnostics during hospitalisation* (n = 81)**		
Neonatal infection	42	51.8
Acute newborn distress	31	38.3
Metabolic disorders	24	29.6
Low birth weight/Prematurity	13	16.1
Acute respiratory distress syndrome	17	21.1
Jaundice	9	11.1
Hypothermia	3	3.7
Anemia	3	3.7

4. Discussion

More than one hundred newborns are born each year to mothers with sickle cell disease at the Yalgado Ouedraogo hospital (Table 4). The main reason for mothers' admission to the maternity unit was vaso-occlusive crisis. Infection, intrauterine growth retardation, prematurity and perinatal asphyxia were the main reasons for

hospitalization in the paediatric ward, while mothers' vaso-occlusive crisis on admission, low birth weight and perinatal asphyxia were the main risk factors associated with neonatal death.

Table 4. Univariable and multivariable analysis of factors associated with mortality in newborns of mothers with sickle cell disease (n = 328).

	Alive (n = 304)	Dead (n = 24)	Univariable	Multivariable		
			P-value[2]	OR	95% IC[1]	P-value[2]
Motifs						
Severe malaria			***0.003***			*0.7*
No	*301 (99%)*	*21 (87.5%)*		*1*	*1.4 - 16.5*	
Yes	*3 (1%)*	*3 (12.5%)*		*7.39*		
Labor			***0.013***			*0 .7*
No	*203 (67%)*	*22 (91.7%)*		*1*		
Yes	*101 (33%)*	*2 (8.3%)*		*0.70*	*0.10 - 3.43*	
V*aso-occlusive crisis*			**<0.001**			**0.032**
No	*248 (82%)*	*12 (50%)*		*1*		
Yes	*56 (18%)*	*12 (50%)*		*3.39*	*1.11 - 11.0*	
Anemia			**0.007**			0.2
No	*281 (92%)*	*18 (75%)*		1		
Yes	*23 (8%)*	*6 (25%)*		2.40	0.60 - 8.64	
Vasculo-renal syndrome			**0.014**			0.081
No	*292 (96%)*	*20 (83%)*		*1.*		
Yes	*12 (4%)*	*4 (16.7%)*		*4.51*	*0.82 - 21.2*	
Threatened premature labor			*0.2*			*0 .4*
No	*300 (99%)*	*23 (95%)*		*1*	-	
Yes	*4 (1%)*	*1 (4.2%)*		*3.86*	*0.14 - 52.6*	
Respiratory distress			**<0.001**			**0.011**
No	*43 (72%)*	*6 (40%)*		*1*		
Yes	*17 (28%)*	*9 (60%)*		*12.6*	*1.6 - 28.6*	
Prematurity			**0.005**			**0.018**
No	*45 (75%)*	*9 (60%)*		*1*		
Yes	*15 (25%)*	*6 (40%)*		*5*	*1.1 - 10.6*	
Hypotrophy			***0.001***			**0.027**
No	*32 (53%)*	*9 (60%)*		*1*		
Yes	*28 (47%)*	*6 (40%)*		*14*	*10.2 - 40*	
Pregnancy term			**<0.001**			0.14
≥37 WA	*251 (82.6%)*	*12 (50%)*		*1*	-	
<37 WA	*53 (17.4%)*	*12 (50%)*		*2.39*	*0.74 - 7.66*	

[1]IC: Interval of confidence; OR: Odd ratio; WA: Weeks of amenorrhea. [2]Khi-deux independence test; Exact test of Fisher.

Majority of mothers had a SC phenotype. This is consistent with the distribution of haemoglobinopathy SC in the Burkinabean population, with an incidence of around 1.8% at birth, while that of haemoglobinopathy SS is 0.5% [6]. It should be noted that complications related to the disease during pregnancy are less common in SC phenotype compared to SS [13] [15].

Similarly to other countries, vaso-occlusive crisis in mothers was the main reason for admission in maternity wards and was the major factor associated with poor prognosis in newborns [16]-[18]. Their impact on fetus could have been mitigated by preventive measures such as systematic blood transfusions, adequate hydration or in some cases prophylactic caesarean sections [19]-[21]. For Bakri *et al*., prophylactic caesarean section is the most effective emergency intervention for the prevention of fetal complications during vaso-occlusive crisis [21]. Compared to other studies elsewhere, caesarean section was relatively rare in our setting [22] [23]. Apprehension for post-cesarean complications, such as nosocomial infections and maternal hemorrhages, which are frequent in this population, may explain this situation. Furthermore, insufficient support from interdisciplinary team may have been one of the reasons for refraining from this procedure [21]-[24].

Prematurity and low birth weight were the most common neonatal complications (21.2%). These are favored by the deterioration of mother's health, especially during the last trimester of pregnancy, marked by severe anemia, vaso-occlusive crisis, vasculo-renal syndrome and infections [25]-[27].

Therefore, an interdisciplinary management team consisting of obstetricians, infectious disease specialists, hematologists, anesthetists, and pediatricians, conversant with sickle cell disease, is vital. On the other hand, the high rate of early neonatal infections highlights the need to promote the use of routine rapid diagnosis tests for common infections in pregnant women with sickle cell disease and their newborns.

Neonatal mortality rate was lower in this population compared to rates published in similar populations in Benin and India, respectively 8% and 16% [12] [28]. It is possible the mortality rate might have been underestimated, considering the large number of children who had no follow-up care. Vaso-occlusive crisis increases the risk of prematurity and perinatal asphyxia, which are also major causes of neonatal deaths. However, maternal hypertension and infections were not explored in this study, while they might have contributed to the high risk of adverse outcome in newborns. The fact that the majority of newborns died in hospital highlights the need for close monitoring of pregnant women with sickle cell conditions and promotion of high-quality intensive care units for newborns. Additionally, specific post-natal care and short-term follow-up after discharge from the maternity is essential, as these newborns remain fragile throughout their first month of life [29] [30].

Surprisingly, severe anemia in mothers was rare (9%) in our study compared to rates published in Benin and India, respectively 17% and 22% [28] [31]. It is possible that severe anemia was managed successfully before pregnant women were referred

to Yalgado Ouedraogo hospital. Another hypothesis is that counselling sessions during prenatal care (iron and folic acid prophylaxis, healthy lifestyles, balanced diet, adequate hydration, control of common infections) might have contributed to mitigation of severe anemia.

The limitations of this study include missing data on pregnant womans' treatment and lifestyle before admission and limited investigations on possible causes of persistent pains. Likewise, Yalgado Ouedraogo, being a referral hospital, patients were in majority admitted in critical condition, which might have led to an overestimation of morbidity and mortality rates in newborns. Also, due to lack of laboratory reagents, pathogens responsible for neonatal infections could not be specified. Lastly, the multivariate analysis was conducted on a subset of 328 newborns with available follow-up data, less than half of the initial cohort, hence the risk of potential selection bias.

5. Conclusion

Improving the survival of babies born to mothers with sickle cell disease in Yalgado Ouedraogo hospital would require excellent interdisciplinary collaboration as well as implementation of high-quality infrastructures and human resources for neonatal intensive care. In addition, newborns ought to be monitored carefully in the first days of life and future prospective studies are necessary to better understand the causes of neonatal deaths in this population.

Conflicts of Interest

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

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