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Epidemiological, clinical and evolutionary aspects of hypotrophic newborns at term at the Mother and Child University Hospital of N'Djamena

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Abstract

Introduction: Hypotrophy is a public health problem in developing countries. Its etiology is multifactorial and it may be associated with high morbidity and mortality. The objective of this study was to describe the epidemiological, clinical and evolutionary profile of hypotrophic newborns at term.

Methodology: this was a prospective, descriptive and analytical study conducted in the neonatology department of the MCUH of N'Djamena from 01/06/2018 to 31/05/2019. It involved 109 hypotrophic newborns at term hospitalized.

Results: The frequency of hypotrophy was 7.8%, the risk factors were: housewife status (81.7%), low level of education (67%), poor pregnancy follow-up (59.7%), malaria (40.4%), urogenital infections (22%) and anemia (22%) during pregnancy. Hypotrophy was harmonious in 58.7% of cases, the sex ratio was 1.14 and visible congenital malformations were observed in 12.7% of cases. The main reasons for hospitalization were neonatal infections (64.2%), perinatal asphyxia (14.7%) and hypothermia (11.9%). Lethality was 16.5% and associated with multiparity, poor pregnancy follow-up, vaginal delivery, home delivery, pathological Apgar score, notion of resuscitation, existence of malformation, respiratory distress and perinatal asphyxia.

Conclusion: Better monitoring of pregnancy, use of family planning by couples, delivery in an institutionalized setting, and reinforcement of the technical platform of the neonatology department will reduce neonatal morbidity and mortality related to hypotrophy.

Keywords: Newborn; Hypotrophy; Etiology; Evolution; N'Djamena

1. Introduction

According to the World Health Organization, birth weight is an important indicator of child health because of the relationship between this variable and infant morbidity and mortality [1]. Not only does it allow an a posteriori estimate of the harmonious growth in utero, but it could also be a determinant marker of risk of disease in adulthood [2]. Defined as a birth weight of less than 2 standard deviations or less than the 10th percentile compared to the general population, i.e. less than 2500 g at term [1, 3, 4], low birth weight is a major public health problem in both developing and developed countries because of its high prevalence and the resulting neonatal consequences. Its prevalence is estimated at 16.5% in developing countries compared to 7% in developed countries [6]. In Chad, according to the 2014-2015 Demographic Health and Multiple Indicator Survey, the low birth weight rate is 7% nationally [7].

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Many factors are involved in the occurrence of hypotrophy as reported by various African authors [3,8-10] and the clinical picture is made of two clinical forms: harmonious hypotrophy and disharmonious hypotrophy.

In many countries with limited resources, such as Chad, there is no specific program for the care of these newborns and the lack of technical facilities could be the cause of the excess mortality of hypotrophic babies. A study carried out on prematurity showed a high mortality rate of 42.4% in relation to the perinatal and neonatal characteristics of the newborns but also to the delay in their care [4]. The situation of hypotrophic babies born at term is poorly documented, whereas a more precise knowledge of this condition and its evolution in the Chadian context characterized by poor health coverage will allow for better actions to be initiated. With this in mind, and given the scarcity of studies devoted to this subject, the present study aims to describe the epidemiological, clinical and evolutionary aspects of hypotrophic full-term babies hospitalized and followed in the neonatology department of the Mother and Child University Hospital (MCUH) in N'Djamena, in order to contribute to the improvement of their care.

2. Patients and methods

2.1. Study design and study population

This was a prospective, descriptive and analytical study conducted in the neonatology department of the MCUH of N'Djamena from June 1, 2018 to May 31, 2019. It involved all hypotrophic newborns born at term and admitted to the MCUH neonatology department during the inclusion period.

Full-term newborns (gestational age ≥ 37 weeks of amenorrhea) with a birth weight of less than 2500, admitted within 72 hours of delivery, and whose parents were consenting were included. Preterm infants, hypotrophs whose parents refused hospitalization or were discharged against medical advice, and those in whom parental consent was not obtained were not included in the study.

Sampling was comprehensive and non-probability based with consecutive recruitment of incident cases during the study period.

2.2. Data collection

Data from the interview, clinical examination on admission, during hospitalization and follow-up were recorded on a predefined collection form. Biological data were collected on the basis of available results. Other sources of data were the patient admission registers and hospitalization records.

In neonatology, newborns were treated according to the neonatal complication associated with hypotrophy. Stabilized neonates weighing less than 2000 g were reared by the mother-kangaroo method. Follow-up after hospitalization was done at 1 week, 2 weeks and 1 month. It consisted of taking anthropometric parameters and looking for medical complications.

The variables considered were socio-demographic (mother's age, mother's level of education, maternal socio-professional status, residence) related to the course of pregnancy (pregnancy follow-up, maternal pathologies during pregnancy, parity, history of low birth weight) and delivery (uterine height, delivery site, mode of delivery, number of fetuses), relative to the newborn (sex, anthropometric parameters, type of hypotrophy, Apgar score, existence and type of visible malformation, anthropometric parameters at birth, neonatal complications) and evolutionary (death, length of stay, complications during follow-up, anthropometric parameters at the end of follow-up).

2.3. Ethics

From an ethical point of view, a favorable opinion from the ethics committee of the Faculty of Human Health Sciences, an administrative authorization from the management of the MCUH, as well as a verbal consent from the parents of the newborn were obtained. The study did not involve any risk to the patients; the confidentiality of the data collected was respected.

2.4. Statistical analysis

The collected data were entered and analyzed using SPSS 18 and Epi info 7 software. A descriptive analysis was performed with calculation of the hospital incidence of hypotophia, the absolute number and percentage for qualitative variables and the mean with its standard deviation for quantitative variables.

A bivariate analysis was performed to assess the association between maternal sociodemographic characteristics, obstetric characteristics, neonatal characteristics, and newborn death during follow-up by calculating the relative risk (RR) with its 95% confidence interval (CI95%). The chi-square test (or Fisher's exact test) was used to compare proportions with a $p<0.05$ significance level

3. Results

3.1. Frequency

During the study period, 1392 newborns were hospitalized in the neonatology department of the CHU-ME for various pathologies, 109 of whom suffered from hypotrophy, i.e., a hospital frequency of 7.8%.

3.2. Characteristics of mothers of hypotrophic newborns

The mothers of the hypotrophic newborns were housewives (81.7%), students (10.7%), students (5.5%) and civil servants (2.7%). Their average age was 25.5 ± 7 years with extremes of 16 and 40 years. The 16-18 age group represented 26.6% of the cases, the 19-35 age group 53.2% and the over 35 age group 20.2%. The mothers were uneducated in 36.7% of cases, primary school in 30.3%, and secondary school in 24.8% and higher education in 8.2%. They lived in urban areas in 80.7% of cases and in rural areas in 19.3% of cases.

Pregnancy follow-up was absent in 13.8% of cases, insufficient in 45.9% and normal in 40.3%. Multiparity was found in 52.3% of cases, primiparity in 26.6% and pauciparity in 21.1%. A history of low birth weight delivery was found in 14.7% of mothers.

The main maternal pathologies causing hypotrophy were malaria (40.4%), urogenital infections (22%) and pregnancy anemia (11%). Other pathologies were: pre-eclampsia/eclampsia (5.5%), hemorrhage (2.8%), toxoplasmosis (0.9%), rubella (0.9%), and syphilis (0.9%). Seventeen mothers (15.6%) had not presented any pathology during the pregnancy.

Delivery took place in a health facility in 88.1% of cases and at home in 11.9% of cases. Uterine height was less than 30 cm in 56% of cases. Delivery was by vaginal route in 87.2% of cases. Multiple pregnancy was involved in 34.9% of hypotrophy.

3.3. Clinical characteristics of hypotrophic newborns

Males represented 53.2% (n = 58) of the cases and females 46.8% (n = 51), i.e. a sex ratio of 1.14.

The average anthropometric parameters at admission were:

- Weight: 1950 ± 398.7 g with extremes of 1000 and 2470 g ;
- Height: 45.5 ± 2.9 cm with extremes of 40 and 51 cm;
- Head circumference: 32.2 ± 2.5 cm with extremes of 26 and 37 cm.

On admission, 54.1% of the hypotrophs had at least 2000 g; hypotrophy was harmonious in 58.7% of the cases and the newborns had been resuscitated in 22% of the cases (Table 1)

Table 1 Distribution of hypotrophic newborns by characteristics at admission (n= 109)

Variable	**n**	**%**
Birth weight (g)		
1000 - 1499	17	15.6
1500 - 1999	33	30.3
≥ 2000	59	54.1
Head circumference (cm)		
< 35	81	74.3
≥ 35	28	25.7
Height (cm)		

< 47	64	58.7
≥ 47	45	41.3
Type of hypotrophy		
Harmonious hypotrophy	64	58.7
Disharmonious hypotrophy	45	41.3
Apgar score at 5 minutes		
≤ 7	12	11
> 7	84	77.1
Unknown	13	11.9
Resuscitation		
Yes	24	22
No	85	78

Malformations were found in 14 hypotrophic newborns, i.e. 12.8% of the cases. These were 5 cases of polymalformative syndrome, 2 cases of hypospadias, 7 cases of cleft lip and palate, facial dysmorphism, microcephaly, spina bifida, omphalocele, laparoschisis and polydactyly.

Neonatal infection was the main complication found (64.2%) followed by perinatal asphyxia (14.7%) and hypothermia (11.9%). Other complications were: neonatal anemia (5.5%), neonatal respiratory distress (2.8%) and hypocalcemia (0.9%).

3.4. Evolution of hypotrophic newborns

The average length of stay was 5.9±3 days with extremes of 1 and 21 days. It was less than or equal to 7 days in 82 cases (75.2%) and greater than 7 days in 27 cases (24.8%).

Table 2 Evolution of hypotrophic newborns according to the socio-demographic and obstetrical characteristics of the mothers (N = 109)

Characteristics		**Death**		**RR**	**$CI_{95\%}$**	**p**
		Yes	**No**			
Age	≤18 or > 35	9 (18%)	42 (82%)	1.1	[0.5 ; 2.6]	0.8
	19-35	9 (16%)	49 (84%)			
Level of education	None/primary	12 (16%)	61 (84%)	0.99	[0.4 ; 2.4]	0.9
	High school and above	6 (17%)	30 (83%)			
Residence	Rural	3 (14%)	18 (86%)	0.8	[0.3 ; 2.6]	0.8
	Urban	15 (17%)	73 (83%)			
Primiparity	Yes	5 (17%)	24 (83%)	1.1	[0.4 ; 2.7]	0.9
	No	13 (16%)	67 (84%)			
Multiparity	Yes	11 (19%)	46 (81%)	1.4	[0.6 ; 3.4]	0.4
	No	7 (13%)	45 (87%)			
Mode of delivery	Low route	16 (17%)	79 (83%)	1.2	[0.3 ; 4.6]	0.8
	Cesarean section	2 (14%)	12 (86%)			
Place of delivery	Home	4 (31%)	9 (69%)	2.1	[0.8 ; 5.4]	0.2
	health facility	14 (15%)	82 (85%)			
ANC	0 - 3	13 (20%)	52 (80%)	1.8	[0.7 ; 4.6]	0.2
	≥ 4	5 (11%)	39 (89%)			

The average anthropometric parameters at discharge were

- Weight: 2025 ± 367.4 g with extremes of 1060 and 2950 g;
- Height: 45.9 ± 2.8 cm with extremes of 39 and 51 cm
- Head circumference: 32.7 ± 2.4 cm with extremes of 26 and 39 cm.

After the first hospitalization, 13 newborns presented complications during the month following the return home, of which 6 were rehospitalized. The main complications were: strangulated inguinal hernia (1), anemia (1), hyperthermia (2), late neonatal infection (6), rhinitis (3).

Eighteen (18) hypotrophic neonates died during the study period representing a case fatality of 16.5%. Deaths occurred during the first week of hospitalization in 10 cases and after 7 days in 8 cases.

The risk of death of hypotrophic newborns was high when the mothers were younger than 18 years or older than 35 years (RR = 1.1), in case of multiparity (RR = 1.4), vaginal delivery (RR = 1.2), home delivery (RR = 2.1), and poor pregnancy follow-up (RR = 1.8), but the association was not statistically significant (Table 2).

The risk of death of hypotrophic newborns was also high in case of male sex (RR = 1.4), weight less than 2000g (RR = 1.2), pathological Apgar score at the 5th minute (RR = 2.3), resuscitation at birth or admission (RR = 1.8), malformation (RR = 1.4), perinatal asphyxia (RR = 2.2), and neonatal respiratory distress (RR = 4.4), but the association was not statistically significant (Table 3).

Table 3 Evolution of hypotrophic newborns according to neonatal characteristics (n = 109)

Characteristics		**Death**		**RR**	**CI95%**	**p**
		Yes	**No**			
Sex	Male	11 (19%)	47 (81%)	1.4	[0.6 ; 3.3]	0.5
	Female	7 (14%)	44 (86%)			
Weight (g)	< 2000	9 (18%)	41 (82%)	1.2	[0.5 ; 2.7]	0.7
	≥ 2000	9 (15%)	50 (85%)			
Apgar pathology	Yes	4 (33%)	8 (67%)	2.3	[0.9 ; 5.9]	0.1
	No	14 (14%)	83 (86%)			
Resuscitation	Yes	6 (25%)	18 (75%)	1.8	[0.7 ; 4.2]	0.2
	No	12 (14%)	73 (86%)			
Malformation	Yes	3 (21%)	11(79%)	1.4	[0.4 ; 4.1]	0.6
	No	15 (16%)	80 (84%)			
Neonatal infection	Yes	10 (14%)	60 (86%)	0.7	[0.3 ; 1.6]	0.4
	No	8 (21%)	31 (79%)			
Perinatal asphyxia	Yes	5 (31%)	11 (69%)	2.2	[0.9 ; 5.4]	0.08
	No	13 (14%)	80 (86%)			
Respiratory distress	Yes	2 (67%)	1 (33%)	4.4	[1.8 ; 11]	0.07
	No	16 (15%)	90 (85%)			
Neonatal anemia	Yes	1 (17%)	5 (83%)	1	[0.2 ; 6.4]	1
	No	17 (17%)	86 (83%)			

4. Discussion

The main results show that hypotrophy at term is frequent in the neonatology department, particularly in its harmonious form. Its occurrence is favored by maternal factors and its outcome marked by a high lethality is a function of both the characteristics of the newborn and those of the mother.

Analysis of the data from this study shows that the hospital frequency of hypotrophy at term in newborns is 7.8% in the neonatology department of the MCUH of N'Djamena. Compared to data from other authors, it is close to the 7% observed by Kakudji et al in Lubumbashi (DRC) in 2017 [11], higher than the 5.6% and 4.8% observed respectively by Lataief in Tunisia and Yao in Ivory Coast in 2015 [1, 5]. However, this frequency is lower than those found by Gueye and al in Senegal in 2012 (12.8%), Kaboré and al in Burkina Faso in 2007 (12.4%) [9, 12]. Although there is a disparity of figures between the different studies, the results all converge towards the conclusion that low birth weight remains a public health problem in African countries. As low birth weight is recognized as a poor prognostic factor by various authors [4, 13, 14], a high proportion in a hospital setting with limited technical facilities probably contributes to the still high neonatal and infant mortality rate in Chad [7].

From an etiological point of view, socio-demographic factors such as maternal age, housewife status and low level of education could be factors favoring low birth weight because of the observations made in this study. However, their real implication could only be highlighted in an analytical study as reported by other authors [15-17].

Indeed, the analysis of the data of the present study shows that the hypotrophic newborns were mostly born to relatively young mothers as reported by other authors [9, 12, 18, 19]. These mothers were largely housewives with no consistent source of income. Their low socio-economic level, their daily workload in the Chadian context, and the low level of education observed in the present study could be one of the explanations for the late admissions and the problems encountered in the care of the newborns.

At the obstetrical level, the absence or poor monitoring of pregnancy, multiparity, multiple pregnancies, a history of low birth weight deliveries, and maternal pathologies were reported in varying proportions, as is the case in other studies [15-17, 20].

Regarding pregnancy monitoring, low birth weight neonates were from pregnancies that were not or poorly monitored in 59.7% of cases, figures comparable to those reported by Mungyeh and al in 2017 in Cameroon, i.e. 57.5% of cases [21]. Multiparity represented 52.3% of cases. This result is higher than that reported by Kaboré and al in Burkina Faso (35.2%) [12].

The main pathologies that could be the cause of hypotrophy in the neonatology department of the MCUH were malaria, urogenital infections and anemia during pregnancy. These results are corroborated by those of Yao and al at the CHU of Treichville in 2015 who concluded that malaria access, urogenital infections and anemia were the main risk factors for hypotrophy [5].

Uterine height, a predictor of fetal weight during pregnancy, was less than 30 cm in the majority of cases. Delivery was by vaginal route and in a health facility in most cases as reported by other authors [1, 21]. Twinning accounted for 34.9% of cases.

Clinically, the newborns were male in 53.2% of cases. This finding is in line with the observations made by Assé and al in 2016 in Côte d'Ivoire and Adjahoto and al in 1999 in Togo [22, 23], which emphasize a predominance of male sex without its role being clearly elucidated. The average anthropometric parameters at birth were low without being extremely small and were close to those reported by Demmouche and al in 2015 in Algeria and Assé et al [8, 22].

Birth weight is a prognostic factor in neonatology, its smaller value is associated with a higher risk of death according to various authors [4, 14]. The analysis of the data of the present study shows that 54.1% of hypotrophic newborns had a weight of more than 2000 g, which is a lower risk situation. Thus, these babies were not eligible for maternal kangaroo care whose contribution to the growth of low birth weight babies was demonstrated by Souam Nguelé and al in 2020 at the MCUH in N'Djamena [13].

Hypotrophy was harmonious or proportional in 58.7% of the newborns included in this study. In the other newborns, only the weight was below normal. This observation is contrary to that made by Mungyeh et al in Yaoundé in 2017 where a predominance of disharmonious hypotrophy of the order of 74% was found [21].

Newborns were hospitalized for various complications associated with hypotrophy. In 12.8% of them, a visible malformation was found. This result is much higher than that of Jedidi et al in whom malformations represented only 0.6% of cases [2]. Poor pregnancy monitoring and the use of self-medication could explain the high frequency of malformations observed in N'Djamena. Other complications that led to the hospitalization of hypotrophic newborns in the neonatology department of the MCUH of N'Djamena were neonatal infection, perinatal asphyxia and hypothermia. These results are similar to those reported by Mungyeh and al [21].

Evolutionarily, the neonates had a relatively short length of stay. The main complications during the first month after discharge were strangulated inguinal hernia, anemia, isolated hyperthermia, malaria, late neonatal infection, cutaneous staphylococcal disease and rhinitis. These complications are not specific to hypotrophic infants born at term since they have also been found in preterm infants by Gongnet and al [24] and could be detrimental to their outcome because of the associated low weight.

The case fatality at the end of follow-up was 16.5%. Although lower than that observed by Mungyeh and al (34.6%) [21], this case fatality remains high and contributes to the high neonatal and infant mortality rate in Chad [7].

The search for prognostic factors led to the conclusion that certain socio-demographic and obstetrical characteristics of the mothers as well as certain neonatal characteristics were associated with a higher risk of death without the statistical association being significant. These prognostic factors are potential in the Chadian context; their role has also been demonstrated in other countries [9, 22, 25]. A multicenter study with a large number of subjects should be conducted to confirm or refute their prognostic value in Chad.

Among the maternal characteristics, extreme ages, multiparity, poor pregnancy monitoring, vaginal delivery and home delivery were associated with a high risk of death. The association between these different factors and death of hypotrophic newborns has been demonstrated by other authors [9, 22].

Regarding the specific characteristics of newborns, male sex, a weight of less than 2000 g, a pathological Apgar score and the notion of resuscitation were associated but not statistically significant with a high risk of death. These different factors have been reported by various authors [1, 4, 5, 9, 22, 25]. Similarly, the presence of malformation, respiratory distress and perinatal asphyxia were associated but not significantly with death in hypotropic newborns.

5. Conclusion

Hypotrophy is frequent at the MCUH of N'Djamena representing 7.8% of hospitalizations in the neonatology department. Its occurrence is favored by certain characteristics: young maternal age, low socio-economic and educational level, poor pregnancy follow-up, malaria, urogenital infections and anemia during pregnancy.

More than half of the newborns had harmonious hypotrophy and 13% of them had visible congenital malformations. The main complications that led to hospitalization were neonatal infections, perinatal asphyxia and hypothermia.

Lethality was high and potentially related to maternal age, multiparity, poor pregnancy monitoring, vaginal delivery, home delivery, pathological Apgar score, notion of resuscitation, existence of malformation, respiratory distress and perinatal asphyxia.

The improvement of women's living conditions, a better monitoring of pregnancy, the adoption of family planning by couples, delivery in an institutionalized setting, as well as the reinforcement of the technical facilities of maternity hospitals and neonatology services will allow for better management and a reduction in neonatal morbidity and mortality.

Compliance with ethical standards

Acknowledgments

The favorable opinion of the ethics committee of the Faculty of Human Health Sciences of the University of N'Djamena, the authorization of the management of the MCUH have been obtained.

Disclosure of conflict of interest

There are no conflicts of interest in connection with this paper

Statement of informed consent

Informed parental consent was obtained for all participants included in this study.

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