Etiological and Prognostic Factors Associated with Low Birth Weight (LBW) at the Pediatrics Department of the Pikine National Hospital Center, Dakar/Senegal

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ABSTRACT

Introduction: Low birth weight (LBW) is a major public health problem in developing countries such as Senegal. Based on this observation, the objective of our study was to determine the etiological and prognostic factors of newborns of LBW admitted to neonatology at the Pediatrics Department of Pikine National Hospital Center.

Material and Method: This were a case-control study, conducted from 1 January2019 to 31 December 2019 at the Pediatrics Department of Pikine National Hospital Center.

We compared 150 newborns of LBW (weight between 2500 and 800 g), and 150 newborns of normal weight (weight between 2500 g and 4000 g).

Results: The most represented maternal age group was between 18 and 35 years of age with proportions of 75.2% for LBW and 76% for controls, respectively. Mothers had a low socio-economic level in most cases (LBW=44.8% vs. controls=55.2%). Regarding pregnancy follow-up, only 25.6% of LBW mothers had performed 4 PNC compared to 74.4% of controls. Most of mothers had pathologies during pregnancy (LBW = 81.31% versus controls = 50.63%). Pregnancy was multiple in 75.5% of cases in LBW compared to 24.5% in controls. Delivery was full-term in only 17.33% among LBWs compared to 92.2% in the control group. The main clinical diagnosis was MFI in the 2 groups (LBW=56.7%, controls=42%). Length of hospital stay was greater than 14 days in 25.52% of cases in LBW compared to 14% in controls. The case fatality rate was 22% for NPCs versus 9.3% for controls. Thus, the etiological factors significantly associated with LBW were: low socio-economic level (p=0.001), maternal obstetric-medical pathologies, including HRP (p=0.002) and preeclampsia (p<0.001), number of PNCs<3 (p < 0.001) and multiple pregnancy (p<0.001). Prognostic factors significantly associated with death were low gestational age (p<0.001) and LBW category (p<0.001).

Conclusion: The etiological and prognostic factors associated with NPF identified in our study prove that their presence in pregnant women is likely to lead to the birth of an NPF and to affect their vital prognosis. Hence the need to promote quality PNCs during pregnancy, to strengthen the technical platform of reference structures and to improve collaboration between gynecologists, obstetricians, and pediatricians for better care of the mother-child couple.

Keywords

LBW, Etiological and prognostic factors, Pikine.

Introduction

Low birth weight is a major public health problem in developing countries with high morbidity and mortality. It remains one of the leading causes of neonatal morbidity worldwide followed by perinatal asphyxia and neonatal infection [1]. The care and future of children born with low birth weight has been significantly improved in developed countries, as opposed to countries with limited resources. According to WHO and UNICEF, of the 130 million children born each year worldwide, 20 million have an LBW, a global prevalence of 15.5%, of which 95.6% are in developing countries, particularly in Asia and Africa [2]. Neonatal mortality remains very high and of concern in Africa, particularly in Senegal (21% of live births) dominated by the LBW whose national prevalence is estimated at 14% [3], however few studies have been carried out on this subject. A better understanding of the factors associated with low birth weight helps prevent the risk of birth and improve its prognosis. It is in this perspective that this study was conducted in a hospital located in the suburbs of Dakar in Senegal whose general objective was to study the etiological and prognostic factors associated with LBW. The specific objectives were to compare epidemiological, sociodemographic, gyneco-obstetric, neonatal and prognostic factors in two groups of newborns of LBW and normal birth weight in the pediatric department of the Pikine National Hospital Center.

Material and Method

Study framework

The study took place at the level of the paediatric department of Pikine National Hospital Center (PNHC), which is a level 3 public health institution (PHI) resulting from a cooperation between the Republic of Spain and the Republic of Senegal. It officially started its activities on 26 December 2006. The Pediatrics Department includes a pediatric emergency department with a capacity of 4 cribs and 1 bed, 3 neonatal units, one of which is in the maternity ward with a capacity of 4 incubators and 4 cribs for each of the units, including 2 units within the pediatrics for newborns inborn and out born.

The medical staff is composed of 2 university hospital pediatricians, 3 pediatrician hospital practitioners, doctors in the process of specialization in pediatrics and students of 5th and 7th year of medicine. The paramedical staff consists of 30 nurses and nursing assistants.

The gynecology-obstetrics department is divided into two sectors housing hospitalizations near the pediatrics department; and the delivery room with a capacity of 9 beds located near one of the neonatal units of the maternity ward (directly admitting newborns inborn), the operating room and the intensive care unit. The staff is composed of 3 university hospital gynecologists, 2 hospital practicing gynecologists, doctors in specialization and 23 midwives and 5 nurses.

Methodology

We conducted a retrospective, descriptive and analytical case-control study over a period of one (1) year, from 1 January 2019 to 31 December 2019. Two groups were selected, consisting of cases and controls defined as follows: Group 1 (Cases = LBW): all newborns aged zero (0) to 28 days, with a low birth weight (weight between 2500 and 800 g), hospitalized in the ward during the study period.

Group 2 (Controls): all newborns aged zero (0) to 28 days, with a normal birth weight (weight between 2500 g and 4000 g), of the same number per year of study as the cases, hospitalized in the same department during the study period.

All newborns with a birth weight of less than 800 g and records that are unusable because they are incomplete were excluded from the study.

In the 2 groups, the data below were collected on a pre-established survey sheet after consulting the hospitalization records, the health record and the liaison sheet for referred newborns.

Maternal epidemiological and socio-demographic data: age, area of origin, marital regime, level of education, occupation, socio-economic level;

Gyneco-obstetrical data: gestural, parity, gyneco-obstetrical history, pregnancy monitoring, medical and obstetric pathologies during pregnancy, evolution of pregnancy and childbirth, term of pregnancy, mode of delivery, place of delivery;

Neonatal data: age at admission, sex, provenance, birth weight, trophicity; reasons for consultation, main diagnosis retained.

Prognostic data: length of hospitalization, mortality, causes of death.

This collected data was entered and analyzed with SSPS 23 software and Microsoft Excel 2019 software.

Results

Epidemiological and Socio-Demographic Factors

A total of 150 LBW newborns and 150 normal-weight newborns were collected during the study period. The hospital prevalence of newborns of LBW was 22.16% in our study. The overall prevalence of total pediatric hospitalizations was 12.52%.

The most represented maternal age group was between 18 and 35 years of age with proportions of 75.2% for LBW and 76% for controls, respectively.

They were illiterate in half of the cases in the two groups. Mothers had a low socio-economic level in most cases (LBW=62.7% vs. controls=80%) with a significant difference (Table 1).

Table 1: Epidemiological and socio-demographic factors.

	Birth weight		
Variables	LBW	Witness	p-value
Age Slice			0.904
<18 years	14 (54.2%)	11 (45.8%)	
[18-35]	112 (74.6%)	114 (76 %)	
>35 years	24 (49.0%)	25 (51.0%)	
Marital status			0.748
Bachelor	4 (40.0%)	6 (60.0%)	
Bride	146 (50.3%)	144 (49.7%)	
Level of education			0.904
Illiterate	115 (50.2%)	114 (49.8%)	
Primary	13 (44.8%)	16 (55.2%)	
Secondary	13 (50.0%)	13 (50.0%)	
Upper	9 (56.2%)	7 (43.8%)	
Level Socioeconomic			0.001
Low	94 (44.8%)	116 (55.2%)	
High	3 (42.9%)	4 (57.1%)	
Medium	53 (67.9%)	25 (32.1%)	

Maternal gyneco-obstetric factors

Mothers were mostly primigestible in both groups and predominantly primiparous in the control group and multiparous to more than three in the LBW group. A history of prematurity and neonatal death was more common in the LBW group with no significant difference (Table 2).

Table 2: Gyneco-obstetric history associated with LBW.

	Birth weight		
Variables	LBW	Witness	p-value
Gestures			0.595
1	49 (45.0%)	60 (55.0%)	
2	30 (54.5%)	25 (45.5%)	
3	28 (50.9%)	27 (49.1%)	
> 3	43 (53.1%)	38 (46.9%)	
Parity			0.162
1	45 (42.5%)	61 (57.5%)	
2	27 (50.0%)	27 (50.0%)	
3	29 (50.9%)	28 (49.1%)	
> 3	49 (59.0%)	34 (41.0%)	
History of prematurity			0.067
No	143 (49.1%)	148 (50.9%)	
Yes	7 (87.5%)	1 (12.5%)	
History of neonatal death			0.441
No	140 (49.3%)	144 (50.7%)	
Yes	10 (62.5%)	6 (37.5%)	

Urogenital infections and maternal diabetes were found proportionally in both groups, with no significant links found.

However, the other maternal medical-obstetric pathologies significantly associated with LBW were preeclampsia and retroplacental hematoma (Table 3).

Table 3: Maternal medical-obstetric pathologies associated with LBW.

	Birth weight		
Variables	LBW	Witnesses	p-value
Preeclampsia			<0.001
No	108 (42.5%)	146 (57.5%)	
Yes	42 (91.3%)	4 (8.70%)	

	Birth weight		
Variables	LBW	Witnesses	p-value
Urogenital infection			1 000
No	124 (50.0%)	124 (50.0%)	
Yes	26 (50.0%)	26 (50.0%)	
Retroplacental hematoma			0.002
No	139 (48.1%)	150 (51.9%)	
Yes	11 (100 %)	0 (0.00%)	
HELLP syndrome			0.122
No	146 (49.3%)	150 (50.7%)	
Yes	4 (100 %)	0 (0.00%)	
Diabetes			1 000
No	146 (49.8%)	147 (50.2%)	
Yes	4 (57.1%)	3 (42.9%)	
Scared uterus			0.571
No	145 (50.5%)	142 (49.5%)	
Yes	5 (38.5%)	8 (61.5%)	

Factors related to pregnancy and childbirth:

Regarding pregnancy follow-up, half of the mothers had benefited from antenatal consultations (PNC) in the 2 groups, however, only 25.6% of LBW mothers had performed 4 PNC compared to 74.4% in the control group with a clearly significant difference. Pregnancy was multiple especially in the LBW group (n=40) versus (n=27) in the control group with a strongly significant difference (p<0.001) most mothers had only performed an ultrasound during pregnancy in both groups. The eutocic lower route was more common in the control group while caesarean section was more common in the LBW group with no significant difference (Table IV).

Table 4: Pregnancy and childbirth data.

	Birth weight		
Variables	LBW	Witnesses	p-value
Prenatal consultations			0.371
No	4 (80.0%)	1 (20.0%)	
Yes	146 (49.5%)	149 (50.5%)	
Number of NPCs			<0.001
1	9 (75.0%)	3 (25.0%)	
2	43 (79.6%)	11 (20.4%)	
3	52 (76.5%)	16 (23.5%)	
4	41 (25.6%)	119 (74.4%)	
Type of pregnancy			<0.001
Multiple (02)	37 (75.5%)	12 (24.5%)	
Multiple (03)	3 (100 %)	0 (0.00%)	
Unique	110 (44.4%)	138 (55.6%)	
Obstetric ultrasounds			0.448
No	18 (58.1%)	13 (41.9%)	
Yes	132 (49.1%)	137 (50.9%)	
Number of ultrasounds			0.907
1	93 (49.7%)	94 (50.3%)	
2	30 (45.5%)	36 (54.5%)	
3	7 (53.8%)	6 (46.2%)	
4	1 (50.0%)	1 (50.0%)	
Mode of delivery			0.413
Eutocic bass	83 (47.7%)	91 (52.3%)	
Caesarean section	67 (53.2%)	59 (46.8%)	

Neonatal factors

Among LBWs, 145 mothers (96.43 per cent) had given birth in a health facility, but 5 mothers (3.57 per cent) delivered at home. Among the controls, all the mothers, 100%, had given birth in a health facility. By low-birth-weight category, more than half of the LBWs (64.67%) had a weight between 2499 g and 1500 g, 28% of the very low birth weight between 1499 g and 1000 g and 7.33% of the extreme low birth weight had a weight between 1000 and 800 g. Birth was premature in 82.67% of cases in LBWs, more than half of which were between 32-37 SA (58%), 22.67% between 28-32 SA and 2% below 28 SA. For controls, the majority of pregnancies (92.2%) were full-term (Table 5).

Table 5: Distribution of Cases and Controls by Term of Pregnancy.

Term of pregnancy	LBW		Witnesses	
	Staff (N.)	(%)	Staff (N.)	(%)
< 28 SA	3	2	0	0
28 — 32 SA	34	22,67	0	0
32 — 37 SA	87	58	11	7,3
> 37 SA	26	17,33	139	92,7
TOTAL	**150**	**100**	**150**	**100**

Clinical factors

Most of LBWs (86.4%) had less than 24 hours of life at admission compared to 71.3% of controls. The sex ratio was 0.94 for LBWs versus 0.47 for controls. Regarding the origin, the majority of LBWs, 84.6% were newborns "inborn", 7.4% came from home and 8% were referred from a health facility. In contrast, among the controls, 65.3% were "inborn" newborns, 14% came from home and 20.7% were referred from a structure.

Reasons for hospitalization were dominated by prematurity (56%) and respiratory distress (39.3%) among LBWs. Among controls, respiratory distress (36%) and lack of cree (23.3%) were the most common reasons.

Table 6: Distribution of cases and controls by selected category.

Variables	Birth Weight		
	LBW	Witnesses	p-value
IAF			**0.002**
No	134 (54.3%)	113 (45.7%)	
Yes	16 (30.2%)	37 (69.8%)	
MFI			**0.015**
No	65 (42.8%)	87 (57.2%)	
Yes	85 (57.4%)	63 (42.6%)	
Prematurity			**< 0.001**
No	112 (42.7%)	150 (57.3%)	
Yes	38 (100 %)	0 (0.00%)	
Neonatal jaundice			0.089
No	147 (51.2%)	140 (48.8%)	
Yes	3 (23.1%)	10 (76.9%)	
Transient tachypnea			0.441
No	144 (50.7%)	140 (49.3%)	
Yes	6 (37.5%)	10 (62.5%)	

For the main clinical diagnosis, maternal-fetal infection was more common in the LBW group (57.4%) compared to 42.6% in the control group.

The same is true for prematurity with clearly significant differences. However, inhalation of amniotic fluid (IAF) was more common in the control group (Table 6).

Prognostic factors

Length of hospital stay was greater than 14 days in 25.52% of cases in LBWs compared to 14% in controls. The case fatality rate was 22% for LBWs versus 9.3% for controls. Prognostic factors significantly associated with death were low gestational age (p<0.001) and LBW category (p<0.001) (Table 7).

Table 7: Distribution of Factors Associated with LBW's Deaths.

Variables	Death		
	No	Yes	P-value
Gestational age:			**<0.001**
<28	2 (40.0%)	3 (60.0%)	
[28-32]	14 (42.4%)	19 (57.6%)	
[32-37]	72 (93.5%)	5 (6.49%)	
>37	27 (84.4%)	5 (15.6%)	
Category Birth:			**<0.001**
[800-999]	3 (27.3%)	8 (72.7%)	
[1000-1499]	26 (61.9%)	16 (38.1%)	
[1500-2499]	88 (91.7%)	8 (8.33%)	
Age at time of death:			1 000
Less than 72H	0 (0.00%)	12 (100 %)	
More than 72H	1 (5.00%)	19 (95.0%)	

Discussion
Epidemiological and socio-demographic factors

The LBW is a common reason for hospitalization in pediatrics in Senegal. In our study, the hospital prevalence of newborns of LBW was very high. This is explained by the fact that the Pikine National Hospital Center is a level 3 public health institution (PHI 3) located in the suburbs and therefore a reference structure where are referred most women likely to pose problems or complications or during pregnancy and / or childbirth. In addition, it also has a maternity ward within it. Higher prevalence was reported in Congo (13.27%) and Cameroon (20.79%) [4.5].

In our study, the majority of mothers were illiterate as reported in the literature. Indeed, the level of education is an important factor related to low birth weight. The low level of education leads to a lack of solicitation of health care and a lack of knowledge, particularly in the importance of pregnancy monitoring and the importance of a balanced diet during pregnancy that can positively influence fetal growth [6-8]. Most of them were also housewives. This could lead to a greater physical workload in performing domestic tasks. Paradoxically, several authors suggest that working mothers are also likely to give birth to a newborn of LBW, because they are often subject to the stress (physical and psychological) responsible for the occurrence of LBW in general and particularly for premature birth [9]. Results close to those of our study were reported in Yemen and Nepal [6,10]. Their socio-economic level was low in more than half of the cases and strongly associated with low birth weight (p=0.001). Indeed, the majority of mothers attending our establishment came from the Dakar suburbs characterized by a

population belonging to a social stratum often disadvantaged compared to the urban population.

Maternal gyneco-obstetric factors

In our study, almost one-third of mothers were primiparous, however no significant association was observed between parity and the occurrence of LBW.

It is usually accepted that birth weight increases with parity and maternal age. Several authors have reported primiparity as a major risk factor for LBW [4,8,10,11]. Almost all mothers (95.3%) had no history of preterm birth. No significant association was observed between preterm birth and the occurrence of LBW. Unlike studies in Nepal, Ghana and Ethiopia where the risk of giving birth to an LBW was twice as high in mothers who gave birth prematurely as in mothers who gave birth at term [10,12,13]. Only 6.7% of mothers had a history of neonatal death. A rate similar to ours was found in the Democratic Republic of Congo (4.6%) [4]. Preeclampsia and retroplacental hematoma (PRH) were significantly associated with LBW in our study. Indeed, these co-morbidity factors are responsible for placental hypoperfusion with fetal repercussions a lack of oxygenation and nutrition. This can lead to IUGR and premature birth. In contrast, in Cameroon, the main obstetric pathologies associated with LBW were malaria (p<0.001), urogenital infections (p = 0.015), high blood pressure (p=0.013) and anemia (p=0.011) [5].

Factors related to pregnancy and childbirth:

For prenatal follow-up, there was a statistically significant link between LBW and several PNC<3. Indeed, good quality PNC prevent the occurrence of an LBW. Thus, a number of PNC<3 would increase the risk of occurrence of LBW, which requires better promotion of reproductive health policy in Senegal. Therefore, optimal prenatal follow-up makes it possible to ensure better monitoring of pregnancy, to detect, prevent and manage any maternal pathology that may cause an LBW. Our results corroborate those of other work done elsewhere in Africa, in Ethiopia, [5,14,15]. We also found a significant association between LBW, and multiple pregnancy as found in Cameroon [5].

Multiple pregnancy is also considered a risk factor for LBW and in particular premature birth due to an inability of the utero-placental environment to meet the nutritional needs of several fetuses.

Factors related to the newborn

The newborns of LBW admitted came from the Pikine NHC in most cases (84.6%), from home in 7.4% and in 8% of cases they were referred from another health facility. These results corroborate those recorded in Cameroon [5]. The high percentage of newborns "inborn" proves that our establishment is a level 3 public institution (EPI 3) with a better technical platform for the care of pregnant women who have gynaecological obstetrical risk factors during pregnancy. Most of LBW newborns (86.4%) had less than 24 hours of life at admission. This reflects the importance of the proximity of the gynecology and pediatric services for the

care of the mother-child couple as soon as possible. Similar results have been found in Côte d'Ivoire 164 [16].

The average birth weight was 1672.92 g ± 467. This weight is similar to that noted in Congo [7], but lower than that reported in India (2570 g ± 360 g) [17]. Most of the cases belonged to the category of very LBW. Our result was close to that reported in Cameroon 149 [5]. The majority of cases had intrauterine growth retardation (IUGR). N-borns were term in only 17.33% among LBWs compared to 92.2% in the control group. This finding has been reported in the literature [18].

Clinical factors

Reasons for admission were dominated by prematurity (56%) and respiratory distress (39.3%). The main clinical diagnosis was MFI in the 2 groups (LBW=56.7%, controls=42%). This proves the frequency of urogenital infections in the 3rd trimester of pregnancy in our developing countries and the vulnerability to infections of newborns of LBW. These results have been found in other studies carried out in Senegal and Côte d'Ivoire [16,18].

Prognostic factors associated with death:

In our study, the mortality rate was 22% among LBWs and was predominantly in the early neonatal period. A higher rate of 34.6% was noted in Côte d'Ivoire [16]. This neonatal mortality could be explained by the fact that LBWs, especially premature infants, have an immaturity of major functions that can lead to multiple complications, especially respiratory, hemodynamic, neurological, and digestive and metabolic.

Neonatal infection was the leading cause of death. Even if there was no significant association with LBW, it remains one of the leading causes of neonatal mortality in our developing countries even in term infants.

Prognostic factors significantly associated with LBW death were low gestational age (p<0.001) and low birth weight category between 1000-1499g (p<0.001). The majority of deaths were recorded in very preterm infants (57.6%) (between 28-32 SA) and the increase in GA was inversely proportional to the death rate. The most affected category of LBW was very low birth weight. The smaller the birth weight, the higher the death rate. In our countries with limited resources, the means of management of LBWs are often limited with a lack of incubators, ventilatory support (CPAP) and parenteral nutrition remains inaccessible to ensure optimal management of LBWs.

Conclusion

The etiological and prognostic factors associated with LBW identified in our study prove that their presence in pregnant women is likely to lead to the birth of an LBW and to affect their vital prognosis. Hence the need to promote an improvement in the socio-economic level of populations in general and pregnant women, particularly in Africa, to ensure better monitoring of pregnancy by quality PNCs during pregnancy, to raise the technical platform

of hospital structures such as the Pikine NHC and to improve collaboration between obstetrician gynecologists and pediatricians for better care of the mother-child couple.

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