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Prevalence of morbidity and mortality of the very low birth weight preterm newborn and factors associated with mortality: A single-center cross-sectional study.

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Abstract

Introduction: Very low birth weight newborns (VLBWN) have high morbidity and mortality, and their care requires a tremendous procedural demand. The objective of the present study was to determine the prevalence of morbidity and mortality of VLBWN and factors associated with mortality in a group of patients in the neonatology service of a regional reference center.

Methods: This cross-sectional study was carried out in the neonatology service of the "José Carrasco Arteaga" Hospital in Cuenca-Ecuador, from January 2012 to December 2018. With a non-probabilistic sampling, VLBWN patients were included. The dependent variable was neonatal mortality. Inadequate prenatal controls, extreme maternal age, hypertensive disease in pregnancy, multiple pregnancies, chorioamnionitis, extreme gestational age, respiratory distress syndrome, necrotizing enterocolitis, and neonatal sepsis were recorded. Prevalence is presented. To determine the association in this trial, we used Odds Ratio (OR) with a confidence interval of 95%, with a significance level of $P < 0.05$.

Results: 239 patients entered the study. The significant morbidities were: hyaline membrane (64%), neonatal hyperbilirubinemia (47.3%), and neonatal sepsis (39.3%). Mortality of 21.7% is evidenced, the leading cause of death was neonatal sepsis (9.2%); the risk factors associated with mortality are chorioamnionitis (OR: 5.66), extreme gestational age (OR: 3.7), syndrome of respiratory distress (OR: 3.9) and necrotizing enterocolitis (OR: 2.86).

Conclusions: Very low birth weight premature infants have a high prevalence of morbidity, and their mortality is associated with maternal and neonatal factors.

Keywords:

MESH: Premature newborn, Birth Weight, Very Low Birth Weight, Gestational Age, Morbidity, Infant Mortality, Cross-Sectional Studies.

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Introduction

A very low birth weight newborn (VLBWN) is defined as a product under 37 weeks of gestation, weighing less than 1,500 grams [1-4]. The VLBWN group represents approximately 1 – 1.5% of all births globally.

Usually, due to their short maturation of organs and systems, this group of neonates can present multiple morbidities, such as respiratory distress syndrome, sepsis, and asphyxia [5, 6].

VLBWN survival is related to maternal factors such as inadequate prenatal care (OR = 11.6), amniotic fluid alterations (OR = 5.3), hypertensive disease in pregnancy (OR = 4.2) [7], maternal age <18 years (OR = 2.07), maternal age ≥35 years (OR = 1.66) [8], and multiple pregnancies (OR = 3.7) [9]. The conditions of the newborns that determine mortality are extreme gestational age (OR = 56.97) [10] and diagnosis of hyaline membrane (OR = 7.98) [11].

In developing countries, low birth weight infants have a 40-fold increased risk of dying, rising to 200-fold for VLBWNs. Mortality in neonatal networks in developed countries such as EuroNeoNet (Europe), Vermont Oxford, Canadian Neonatal Network, and the National Institute of Child Health and Human Development (NICHD, USA) varies between 12.4 and 28% [12, 13]. In South America, mortality represents 50-70% of global neonatal mortality [4], and specifically in Argentina, a mortality of 22.3% has been reported in children with VLBWNs [14].

Statistics in Ecuador report low birth weight newborns in 8-8.9% [15-17] without clarifying the prevalence of the VLBWN subgroup.

Due to our region's lack of specific data, we ask ourselves the following research question: What is the prevalence of morbidity and mortality of the very low birth weight preterm newborn in José Carrasco Arteaga Hospital, Ecuador Cuenca, 2012? - 2018? What are the factors associated with mortality? We proposed a cross-sectional study to answer these questions.

Population and methods

Type of study

The present study is observational-analytical-cross-sectional.

Stage

The study was carried out in the neonatology service of the José Carrasco Arteaga specialty hospital of the Ecuadorian Institute of Social Security in Cuenca-Ecuador. The study period was from January 1, 2012, to December 31, 2018.

Universe and Sample

The VLBWN patients admitted to the institution were taken as the universe. The sampling was a nonprobabilistic census type.

Participants

Newborns of both sexes weighing between 1000 and 1500 grams were included. Patients whose records were incomplete were excluded from the analysis.

Variables

The dependent variable was neonatal mortality. The independent variables were the following factors:

Maternal factors: inadequate prenatal controls, extreme maternal age, hypertensive disease, multiple pregnancies, chorioamnionitis.

Neonatal factors: extreme gestational age, sex of the newborn, respiratory distress syndrome, necrotizing enterocolitis, and neonatal sepsis.

Procedures

The method used was observational by reviewing the medical records of the patients. A review of the medical records in the institutional system (AS400) was carried out, and the data were recorded in a validated form.

Statistical analysis

Data were entered and analyzed in the statistical program SPSS version 15 (Chicago: SPSS Inc.). The prevalence of morbidity and mortality was obtained based on the following formula:

Prevalence of morbidity = (Population with morbidity)/(Study population) x 100

Mortality prevalence = (number of deaths)/(study population) x 100.

A descriptive analysis of the qualitative variables was performed. As there were simultaneous pathologies, an individual analysis was performed with absolute frequency. To determine the relationship between neonatal mortality and maternal and neonatal risk

factors, Pearson's Chi^2 correlation was used, and the odds ratio (OR) was used to measure the intensity of the association with a 95% confidence interval, with a significance level of $P < 0.05$.

Results

A total of 239 patients entered the study.

General characteristics

In the table 1, the demographic characteristics of the study population are described. The highest prevalence was found in men (57.7%), with a higher prevalence of very premature birth (46%), mothers between 19 and 34 years old (74.5%), secondary education level (47.7%), and urban origin (70.3%).

Table 1. Sociodemographic characteristics.

Variable		N=239	%
Sex	Men	138	57.7
	Women	101	42.3
Gestational age	Extreme preemies	7	2.9
	Very premature	110	46.0
	Moderate premature	78	32.6
	Late preterm	44	18.4
Maternal age	≤ 18 years	9	3.8
	19 – 34 years	178	74.5
	≥ 35 years	52	21.7
Level of instruction	None	1	0.4
	Primary	52	21.8
	High school	114	47.7
	Superior	72	30.1
Origin	Urban	168	70.3
	Rural	71	29.7

Morbidity

Table 2 presents the absolute frequency of the significant morbidities of VLBWNs. The most prevalent pathology was respiratory distress syndrome, and within it, the hyaline membrane predominated (64%). Other important pathologies were neonatal hyperbilirubinemia (47.0%) and early neonatal sepsis (39.3%). Relevant pathologies included patent ductus arteriosus (23.4%), intraventricular hemorrhage (11.3%), necrotizing enterocolitis (11.3%) and retinopathy of prematurity (1.6%).

Mortality

The recorded mortality was 21.7%. The leading cause of death was neonatal sepsis, pulmonary hemorrhage, and necrotizing enterocolitis (Table 3).

Table 2. Pathologies recorded in the study group

Pathology	N=239	%
Hyaline membrane	153	64.0
Neonatal hyperbilirubinemia	113	47.3
Early Sepsis	94	39.3
Transient Tachypnea	75	31.8
Late Sepsis	65	27.2
Patent Ductus Arteriosus	56	23.4
Apnea	28	11.7
Necrotizing enterocolitis	27	11.3
Grade I intraventricular hemorrhage	12	5.0
Neonatal hypoglycemia	11	4.6
Grade II intraventricular hemorrhage	8	3.3
Intraventricular hemorrhage Grade III	4	1.7
Retinopathy of Prematurity	4	1.6
Grade IV intraventricular hemorrhage	3	1.3

Table 3. Mortality of Very Low Birth Weight.

Variable	F	%	CI 95%
Neonatal sepsis	22	9.21	8.97-9.44
Pulmonary hemorrhage	19	7.95	7.73-8.17
Necrotizing Enterocolitis	11	4.60	4.43-4.77
Mortality	52	21.76	21.42-22.10

In table 4, regarding maternal factors, there was a statistically significant association between mortality from the VLBWN and the presence of chorioamnionitis (OR: 5.66 CI: 1.71-18.67). No association was found with inadequate neonatal controls, hypertensive pregnancy disease, extreme maternal age, or multiple pregnancies. Table 4 presents the neonatal factors that have a statistically significant association with mortality: gestational age, respiratory distress syndrome, and necrotizing enterocolitis. No significant association was found between the sex of the newborn and neonatal sepsis.

Table 4. Relationship between Mortality and Neonatal Factors

Variable	Mortality Yes n = 52	Mortality No n=187	OR	CI 95%	P*
Maternal factors					
Inadequate prenatal controls (<5)	17 (32.69%)	38 (20.32%)	1.90	0.96 – 3.76	0.61
Extreme maternal age (<19 and >34 years)	12 (23.07%)	56 (29.94%)	0.94	0.34 – 1.43	0.33
Hypertensive disease of pregnancy	12 (23.07%)	61 (32.62%)	0.62	0.30 – 1.26	0.18
Multiple pregnancies	1 (1.92%)	17 (9.09%)	0.19	0.025 – 1.50	0.083
Chorioamnionitis	7 (13.46%)	5 (2.67%)	5.66	1.71 – 18.67	0.02*
Neonatal factors					
Respiratory Distress Syndrome1	44 (84.61%)	109 (58.29%)	3.9	1.75 – 8.82	<0.0001*
Extreme Gestational Age (<32 weeks)	38 (73.07%)	79 (42.2%)	3.7	1.88 – 7.31	<0.0001*
Necrotizing Enterocolitis	11 (21.15%)	16 (8.56%)	2.86	1.23 – 6.64	0.011*
Neonatal sepsis	38 (73.07%)	121 (64.71%)	1.48	0.748 – 2.92	0.258
Male gender	30 (57.69%)	108 (57.75%)	0.99	0.53 – 1.85	0.99

*Significance: < 0.05, 1 Hyaline Membrane

Discussion

This study shows that 100% of VLBWNs after birth have complications. The pathology of respiratory distress with hyaline membrane was the most frequent in 64%, followed by neonatal hyperbilirubinemia in 47.3% and early neonatal sepsis in 39.3%. Similar results have been reported previously [5, 6]. As the hyaline membrane is the most frequent diagnosis, the recommendations for corticosteroids in pregnant women with high-risk pregnancies continue to be correct. Morbidity is inversely related to gestational age and weight, but with the VLBWN, no gestational age is entirely free of morbidity.

Mortality in this study was 21.7%, similar to that reported in the Red Neocosur (Chile) at 26% [2]. In European networks, mortality has been lower by 12.4% (EuroNeoNet, Vermont Oxford, Canadian Neonatal Network, NICHD) [12]; this difference may probably be related to greater access to technology, monitoring, and specific medications in specialized neonatal intensive care units for infants with deficient birth weight. This study showed that the leading cause of death was neonatal sepsis (9.2%), followed by pulmonary hemorrhage (7.9%) and necrotizing enterocolitis (4.6%). Similar data were reported in a study in Mexico [6] and Bolivia [18]. Neonatal sepsis continues to be a tremendous challenge for neonatal services; Globally, 15% of newborns die from this cause, and in nondeceased patients, it is associated with poor long-term neurodevelopment and high hospital costs [19].

One of the essential objectives of this study is to provide adequate information regarding maternal and neonatal factors related to mortality, showing that the only crucial maternal factor is chorioamnionitis (OR = 5.66); Ticona also reported this finding - Rendon et al., with OR of 7.5 [7]; the relationship is given by the presence of risk of infection 30 times in premature newborns with chorioamnionitis and to this is added immune immaturity [20]. Regarding neonatal factors, gestational age (<32 weeks) was inversely related to mortality, with an OR of 3.7. It has been reported that the group with the highest risk of dying is the one with a gestational age of fewer than 34 weeks (OR = 56.97) [10]. After respiratory immaturity presented by premature VLBWN patients, the highest percentage develop a respiratory distress syndrome, which implies the need for an early approach, a possible aggressive invasion of the neonate, either by the administration of surfactant up to the requirement of mechanical ventilation. In this study, respiratory distress has an odds ratio of 3.9; in other centers, it has been reported as the most significant risk factor, with an OR of 7.9 [11] until 13.81 [12].

Necrotizing enterocolitis in infants with deficient birth weight can cause up to 50% [21]. The present study had an OR of 2.86, very similar to regional reports [22].

This research work provides essential data related to the significant morbidities of preterm infants with

deficient birth weight, as well as the prevalence of mortality and its associated factors, being of great interest and a continuous challenge for the professional facing the management of this group of patients, who, although, with the advancement of knowledge and the development of newborn units have managed to survive, does not imply the complete resolution of their health problems, even more so due to the significant sequelae they present in the short and long term. Therefore, more emphasis should be placed on developing protocols, addressing these causes associated with mortality, and promoting prevention measures. This study's limitations are the incomplete completion of maternal and neonatal data in the files and documentation of perinatal control and postnatal history. It is necessary to continue with the investigation in our community to offer more detailed information in the future in our locality.

Conclusions

The prevalence of morbidity in deficient birth weight preterm infants was hyaline membrane (64%), followed by neonatal hyperbilirubinemia (47.3%) and early neonatal sepsis (39.3%). The prevalence of mortality was 21.7%, and the leading causes of death were neonatal sepsis (9.2%), pulmonary hemorrhage (7.9%), and necrotizing enterocolitis (4.6%). The primary maternal factor associated with mortality was chorioamnionitis (OR = 5.6), and among the neonatal factors, the main factors were respiratory distress syndrome (OR = 3.9), extreme gestational age (< 32 weeks of gestation) (OR = 3.7) and necrotizing enterocolitis (OR = 2.8).

Abbreviations

OR: Odds Ratio.
VLBWN: Very low birth weight newborn (1000 to 1500 gr).

Supplementary information

Supplementary materials are not declared.

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Author contributions

Ruth Irene Cabrera Garay: Conceptualization, Data Retention, Fundraising, Research, Resources, Software, Writing - original draft.
Karina Alexandra Merchán Astudillo: Curation of data, research, acquisition of funds, supervision, methodology.
Ximena Margoth Bermeo Guartambel: Data curation, research, acquisition of funds, supervision, methodology.
All authors read and approved the final version of the manuscript.

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Availability of data and materials

The data sets generated and analyzed during the current study are not publicly available due to participant confidentiality but are available through the corresponding author upon reasonable academic request.

Statements

Ethics committee approval and consent to participate

The Research Bioethics Committee approved the research protocol for the Health area of the University of Cuenca-(COBIAS).

Publication consent

It does not apply to studies that do not publish MRI/CT/Rx images or physical examination photographs.

Conflicts of interest

The authors declare no conflicts of interest.

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