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Epidemiological characteristics and deaths of premature infants in a referral hospital for high-risk pregnancies

Características epidemiológicas e óbitos de prematuros atendidos em hospital de referência para gestante de alto risco

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ABSTRACT

Objective: To analyze the process of care provided to premature infants in a neonatal intensive care unit and the factors associated with their mortality.

Methods: Cross-sectional retrospective study of premature infants in an intensive care unit between 2008 and 2010. The characteristics of the mothers and premature infants were described, and a bivariate analysis was performed on the following characteristics: the study period and the "death" outcome (hospital, neonatal and early) using Pearson's chi-square test, Fisher's exact test or a chi-square test for linear trends. Bivariate and multivariable logistic regression analyses were performed using a stepwise backward logistic regression method between the variables with $p<0.20$ and the "death" outcome. A p value <0.05 was considered to be significant.

Results: In total, 293 preterm infants were studied. Increased access to complementary tests (transfontanellar ultrasound and Doppler echocardiogram) and breastfeeding rates were indicators of improving care. Mortality was concentrated in the neonatal period, especially in the early neonatal period, and was associated with extreme prematurity, small size for gestational age and an Apgar score <7 at 5 minutes after birth. The late-onset sepsis was also associated with a greater chance of neonatal death, and antenatal corticosteroids were protective against neonatal and early deaths.

Conclusions: Although these results are comparable to previous findings regarding mortality among premature infants in Brazil, the study emphasizes the need to implement strategies that promote breastfeeding and reduce neonatal mortality and its early component.

Keywords: Infant, premature; Breast feeding; Perinatal care; Early neonatal mortality; Neonatal mortality (Public Health); Sepsis; Intensive care, neonatal

INTRODUCTION

Prematurity is a significant concern in public health[1], particularly in underdeveloped countries, because of the poor health condition of the pregnant woman.[2] Brazil is a signatory to the Millennium Development Goals (MDGs), and the goal of reducing the infant mortality rate depends on reducing the early neonatal component of this rate, which is closely linked to problems in the health care provided to pregnant women and newborns.[2-5] Infant mortality in Brazil has been reduced, but there has been little change in the early neonatal component of this rate, which is strongly influenced by perinatal causes.[4-6] Among these deaths, 61.4% are associated with prematurity, which is thus significant in infant deaths.[3,7]

The survival of premature infants, especially those with very low birth weight, is closely related to the quality of antenatal and perinatal care and the structure

of neonatal care in the various regions and countries of the world.[2] The results of evaluation studies examining delivery and childbirth care and its influence on infant mortality indicate that in addition to population risk profile, the quality of hospital care is an important factor for the differences in mortality rates between hospitals in countries where most deliveries are institutionalized, such as in Brazil.[8,9]

Monitoring the population profile and perinatal care at hospital and network levels using reliable data, which are properly collected and stored and include key indicators of basic perinatal care, is a critical strategy for implementing effective interventions, aiming for potentially improved clinical practices.[10-12] In Brazil, with respect to the process of organizing perinatal care networks, the project is lagging.[13]

In this context, this study aimed to analyze the process of care provided to premature infants in a neonatal intensive care unit (NICU) and factors associated with their mortality.

METHODS

Characteristics of the study

This report presents a cross-sectional retrospective study of data for premature infants admitted to the NICU at Hospital São Sebastião (HSS) in Viçosa (MG) from 1 January 2008 to 31 December 2010 and followed from admission until discharge from the unit. Data were obtained from medical records using a semi-structured form.

Since 2009, HSS has become a referral hospital in the care for women with high-risk pregnancies. The NICU at HSS opened in March 2004 and had treated a total of 1059 infants up to December 2010, 70% of who were premature. In 2009, a human milk bank was established, enabling the use of pasteurized human milk in the NICU and strengthening the implementation of the Kangaroo Mother Care method. That same year, a portable ultrasound machine was purchased (HSS unpublished data).

Infants were included in the study if they were born preterm with a birth weight (BW) >500 g and were admitted to the NICU at HSS during the specified period and if their data were available in their medical records. The first admission of each newborn until his/her discharge or death was considered. Infants with malformations incompatible with life were excluded.

The study was approved by the Ethics Committee on Human Research of the Universidade Federal de Viçosa (UFV) under the protocol number 063/2011/CEPH, which was exempt from obtaining informed consent.

Variables analyzed

The following parameters were studied: maternal age (<20, 20-34 and ≥35 years),[14,15] mother's residence (Viçosa, other municipalities), received prenatal care (at least one visit),[2,16,17] twin pregnancy,[14] use of antenatal corticosteroids (at least one dose for pregnancies lasting <35 weeks),[18] delivery and maternal illnesses (hypertension, bleeding in the last trimester, diabetes, heart disease and infection, including chorioamnionitis, pneumonia, urinary tract infection and intrapartum fever).[15]

Gestational age (GA) was defined as the best estimate between the early pregnancy ultrasound (<20 weeks), date of last menstrual period, obstetric notes and clinical examination by New Ballard score.[17,19] Infants were categorized as being extremely premature when their GA was <28 weeks, very premature with a GA between 28 and 31 weeks and moderately premature with a GA between 32 and 36 weeks.[20,21]

BW was categorized as 501-999 g, 1,000-1,499 g, 1,500-2,499 g and ≥ 2,500 g. The BWs were considered low birth weights (LBW) when <2,500 g, very low birth weights (VLBW) when <1,500 g and extremely low birth weight (ELBW) when <1,000 g.[20,21]

Small for gestational age (SGA) at birth was based on the intrauterine growth curves published by Lubchenco et al.[22] as values below the 10th percentile. The intrauterine growth restriction (IUGR; decrease in the growth rate of the fetus documented by at least two measurements of fetal growth evaluation) was recorded.[23-25]

A 5-minute Apgar score <7 was used to evaluate the general conditions at birth.[15] The Clinical Risk Index for Babies (CRIB) was used to evaluate the initial clinical severity in premature infants with BW <1,500 g.[26]

The birth location of the newborn (birth at another hospital),[27] gender and length of hospitalization were also evaluated. The morbidities studied included hyaline membrane disease (HMD), bronchopulmonary dysplasia (BPD),[20,28] patent ductus arteriosus (PDA),[20] late-onset neonatal sepsis,[29] necrotizing enterocolitis (NEC),[20,30] asphyxia,[2,15] and severe peri-intraventricular hemorrhage (grades III or IV PIVH).[31] Propedeutics performed included transfontanellar ultrasonography (TFUS)[32] and doppler echocardiogram (DEcho).[20]

The corrected gestational age (GA) and feeding at discharge were also recorded. Feeding was characterized as breastfeeding (BF; exclusively breastfed and supplemented) and artificial feeding (AF; formula).[15,33,34] The conditions at discharge were categorized as: home, hospital nursery and transferred to the hospital of the city of origin or to

another hospital (i.e., based on the need for heart surgery or another more complex procedure).

The outcome variable "hospital mortality" (total deaths during the first hospitalization, independent of the age at which it occurred) was characterized according to the age at which it occurred as "neonatal death" (in the first 27 days after birth) or as "early death" subset of this variable (in the first 6 days after birth).[15,35]

Statistical analysis

For the descriptive analyses, the median, maximum and minimum values, frequencies and absolute numbers of the maternal and neonatal characteristics were determined and evaluated each year and for the entire study period. Pearson's chi-square test, Fisher's exact test or chi-square for linear trends were used for bivariate analyses between maternal and premature infant variables and the study period and for the outcome variables "hospital mortality", "neonatal death" and "early death". The stepwise backward bivariate and multivariable logistic regression methods were used to examine the explanatory variables that had p values <0.20 on univariate analyses and their relation to the outcome variable "death". P values <0.05 were considered significant. The statistical software programs Statistical Package for Social Science (SPSS) version 17.0 (IBM, Armonk, NY, USA) and Stata version 9.1 (College Station, TX, USA) were used for the analyses.

RESULTS

During the study period, 502 patients were admitted to the NICU, including 336 premature infants (66.9%). The records for 41 patients (12.3%) were not available; thus, the study population consisted of 293 patients.

Population characteristics and care provided

The median maternal age during the study period was 26.0 years (13.0 to 45.0). The respective medians for GA and BW of the premature infants were 32.5 weeks (23.0 to 36.5 weeks) and 1,610 g (520-4,470 g). Moderately premature infants were the most predominant followed by very premature and extremely premature infants.

Notably, in the last year evaluated, there was a significant increase in the rates of receipt of pre-natal care (95.2%) and antenatal corticosteroid use (57.4%) (Table 1). The rates of TFUS, DEcho and BF at discharge also showed significant increases in 2010, with respective values of 72.4%, 26.7% and 50.6%. IUGR was less frequent in 2008 (Table 2).

The median length of stay in the NICU was 16.0 days (1.0 to 119.0 days). However, ignoring the deaths (13.3%), the observed median was 18.0 days (1.0 to 119.0 days) in the NICU, the GA was 36.0 weeks (29.6 to 47.1 weeks) at discharge and the infant's average weight was 2119 g (1060-4302 g) at discharge. As for the conditions at discharge, 44.4% were transferred to the nursery of the same hospital, 27.3% were discharged to home and 15% were transferred to the origin hospital or to other hospitals.

Analysis of mortality of the premature infants

It was observed that 13.3% of the population died in the hospital, resulting in an 86.7% survival rate, which was directly related to the GA. Accordingly, 47.5% of the extremely premature infants, 13.8% of very premature infants and 4.8% of the moderately premature infants died.

The outcomes "hospital mortality", "neonatal" and "early" were analyzed using bivariate analyses between maternal and premature infant characteristics. It was observed that 11.3% of the premature infants (n=33) died during the neonatal period (neonatal death) and that 7.8% (n=23) died in the early neonatal period (early death); 84.6% of all deaths occurred during the neonatal period, of which 59% were concentrated in the early neonatal period (Table 3).

Table 1 - Maternal and care characteristics, according to study period

Variables	Year 2008 N=95	Year 2009 N=93	Year 2010 N=105	Total N=293
Mother's age (years)				
<20	14 (17.5)	17 (21.2)	20 (21.0)	51 (20)
20-34	53 (66.2)	49 (61.2)	64 (67.4)	166 (65.1)
>35	13 (16.2)	14 (17.5)	11 (11.6)	38 (14.9)
Mother's residence				
Viçosa	35 (36.8)	26 (28.0)	33 (32.0)	94 (32.3)
Other municipalities	60 (63.2)	67 (72.0)	70 (68.0)	197 (67.7)
Received pre-natal care*	15 (83.3)	14 (60.9)	40 (95.2)	69 (83.1)
Antenatal corticosteroids**	15 (25.9)	17 (30.9)	39 (57.4)	71 (39.2)
Twin pregnancy	13 (13.7)	10 (10.7)	20 (19.0)	43 (14.7)
Maternal illnesses				
Hypertensive disorders	23 (27.4)	20 (24.4)	29 (29.9)	72 (27.4)
Infections	11 (13.1)	19 (23.7)	17 (17.5)	47 (18.0)
Hemorrhages	7 (8.3)	11 (13.4)	10 (10.3)	28 (10.6)
Diabetes	2 (2.4)	-	4 (4.1)	6 (2.3)
Heart diseases	1 (1.2)	1 (1.3)	-	2 (0.8)
Delivery method				
Vaginal	39 (35.8)	32 (35.2)	39 (37.9)	105 (36.3)
Cesarean	61 (64.2)	59 (64.8)	64 (62.1)	184 (63.7)

Hemorrhages - bleeding in the last quarter. Results are expressed as numbers (%). The category percentages refer to the total number of valid records and do not consider the missing data. There were differences between periods for the variables: receiving pre-natal care and antenatal corticosteroids. * 2009 < 2010 (p=0.001); ** considering <35 weeks; 2008 versus 2010 (p<0.0001) and 2009 versus 2010 (p=0.003).

Table 2 - Characteristics of the premature infants, tests performed, conditions at discharge and feeding at discharge, according to the study period

Variables	Year 2008 N=95	Year 2009 N=93	Year 2010 N=105	Total N=293
Birth at another hospital	15 (15.8)	20 (21.5)	16 (15.2)	51 (17.4)
5-minute Apgar <7	8 (9.5)	11 (13.3)	12 (12.4)	31 (11.7)
Gestational age (weeks)				
<28	15 (15.8)	6 (6.5)	19 (18.1)	40 (13.6)
28-31	23 (24.2)	32 (34.3)	32 (30.5)	87 (29.7)
32-36	57 (60)	55 (59.2)	54 (51.4)	166 (56.7)
Birth weight (g)				
501-999	18 (18.9)	8 (8.6)	18 (17.2)	44 (15.0)
1.000-1.499	21 (22.2)	32 (34.4)	35 (33.3)	88 (30.1)
1.500-2.499	40 (42.1)	39 (41.9)	43 (40.9)	122 (41.6)
≥2.500	16 (16.8)	14 (15.1)	9 (8.6)	39 (13.3)
SGA	10 (10.5)	11 (11.8)	12 (11.4)	33 (11.3)
IUGR*	1 (1.1)	11 (11.8)	8 (7.6)	20 (6.8)
Gender				
Male	51 (53.7)	51 (54.8)	59 (57.3)	161 (55.3)
Female	44 (46.3)	42 (45.2)	44 (42.7)	130 (44.7)
Morbidities				
HMD	43 (45.3)	40 (43.0)	52 (49.5)	135 (46.1)
Late-onset sepsis	28 (29.5)	24 (25.8)	24 (22.9)	76 (25.9)
BPD	15 (19.7)	7 (8.5)	8 (9.5)	30 (12.4)
PDA	10 (10.5)	8 (8.6)	18 (17.1)	36 (12.3)
Severe PIVH	-	5 (14.2)	7 (9.2)	12 (9.0)
NEC	-	4 (4.3)	3 (2.9)	7 (2.4)
Tests performed				
TFUS**	25 (26.3)	34 (36.6)	76 (72.4)	135 (46.1)
DEcho***	7 (7.4)	19 (20.4)	28 (26.7)	54 (18.4)
Conditions at discharge				
Home	21 (22.1)	32 (34.4)	27 (25.7)	80 (27.3)
Nursery	47 (49.5)	36 (38.7)	47 (44.8)	130 (44.4)
Transfer	12 (12.6)	18 (19.4)	14 (13.3)	44 (15.0)
Death	15 (15.8)	7 (7.5)	17 (16.2)	39 (13.3)
Feeding at discharge****				
BF	23 (29.5)	34 (41)	44 (50.6)	101 (40.6)
AF	55 (70.5)	49 (59)	43 (49.4)	147 (59.4)

SGA - small for gestational age, IUGR - intrauterine growth restriction; HMD - hyaline membrane disease; BPD - bronchopulmonary dysplasia, PDA - patent ductus arteriosus; PIVH - severe peri-intraventricular hemorrhage (grades III or IV); NEC - necrotizing enterocolitis; TFUS - transfontanellar ultrasonography; DEcho - Doppler echocardiogram; BF - breastfeeding (exclusive or supplemented), AF - artificial feeding (formula). Results are expressed as numbers (%). The category percentages refer to the total number of valid records and do not consider the missing data. There were differences between the periods for IUGR, TFUS, DEcho and feeding at discharge. * 2008 versus 2009 (p=0.003), 2008 versus 2010 (p=0.037); ** 2008 versus 2010 (p<0.0001), 2009 versus 2010 (p<0.0001); *** 2008 versus 2009 (p=0.009), 2008 versus 2010 (p<0.0001); **** 2008 versus 2010 (p=0.005).

Table 3 - Maternal characteristics according to the deaths of premature infants

Variables	Hospital death N=39	p value	Neonatal death N=33	p value	Early death N=23	p value
Mother from another municipality		0.463*		0.413*		0.600*
Yes	13.7		11.7		8.1	
No	10.6		8.5		6.4	
Received pre-natal care		0.711**		1.000**		0.617**
Yes	17.4		13.0		8.7	
No	21.4		14.3		14.3	
Antenatal corticosteroids***		0.068*		0.019*		0.032*
Yes	8.5		4.2		2.8	
No	18.2		15.5		11.8	
Twin pregnancy		0.535*		0.294**		0.353**
Yes	16.3		16.3		11.6	
No	12.8		10.4		7.2	
Hypertensive syndrome		0.666*		0.765*		0.441*
Yes	11.1		9.7		5.6	
No	13.1		11.0		8.4	
Infections		0.346*		0.288*		1.000**
Yes	8.5		6.4		6.4	
No	13.6		11.7		7.9	
Cesarean delivery		0.512*		0.247*		0.458*
Yes	12.5		9.8		7.1	
No	15.2		14.3		9.5	

Results are expressed as numbers (%). The category percentages refer to the total number of valid records and do not consider the missing data. Tests were considered significant if p<0.05.* p value according to Pearson's chi-square test. ** p value according to Fisher's exact test. *** Considering those <35 weeks.

Table 4 indicates that the use of antenatal corticosteroids was associated with a lower incidence of neonatal and early deaths. Mortality decreased significantly as the GA increased, and the deaths of extremely premature infants were concentrated in the early neonatal period. Neonatal and early deaths were associated with a 5-minute Apgar score <7, a CRIB score ≥10, and SGA at birth and HMD. Late-onset sepsis was associated with neonatal death, whereas PDA and NEC were only associated with hospital death (post-neonatal period). However, there were no differences when evaluating the three death outcomes for the three years of study (p>0.05).

Variables with p<0.20 were examined using logistic regression, as shown in table 5. Bivariate logistic regression was only used for the variables use of antenatal corticosteroids, CRIB score ≥10 and late-onset sepsis because they refer to different subpopulations of the study. The use of antenatal corticosteroids exhibited protective associations against neonatal death and early death. Late-onset sepsis was still associated with hospital and neonatal mortality. A CRIB score ≥10 did not persist as being associated with the deaths.

After the multivariable logistic regression analysis between the other variables with p values <0.20 and the three death outcomes, i.e., GA <28 weeks, SGA at birth and 5-minute Apgar <7, were still significant for all three outcomes. The NEC was still only associated with hospital deaths (post-neonatal period).

Table 4 - Characteristics of the premature infants according to deaths

Variables	Hospital death N=39	p value	Neonatal death N=33	p value	Early death N=23	p value
Born in another hospital		0.316*		0.272*		0.568*
Yes	17.6		15.7		9.8	
No	12.4		10.3		7.4	
GA (weeks)		<0.0001**		<0.0001**		<0.0001**
<28	47.5		40.0		27.5	
28-31	13.8		12.6		8.0	
32-36	4.8		3.6		3.0	
IUGR		1.000***		1.000***		0.663***
Yes	10.0		10.0		10.0	
No	13.6		11.4		7.7	
SGA		0.001***		0.005***		0.032***
Yes	33.3		27.3		18.2	
No	10.8		9.2		6.5	
Gender		0.113*		0.640*		0.904*
Male	10.6		10.6		8.1	
Female	16.9		12.3		7.7	
5-minute Apgar <7		<0.0001***		0.002***		<0.0001***
Yes	35.5		29.0		29.0	
No	9.9		8.2		5.2	
CRIB ≥10****		<0.0001*		<0.0001*		<0.0001***
Yes	66.7		63.0		44.4	
No	10.1		5.1		2.5	
HMD		<0.0001*		<0.0001*		<0.0001*
Yes	23.7		20.7		14.1	
No	4.4		3.2		2.5	
PDA		0.036***		0.265***		0.751***
Yes	25.0		16.7		5.6	
No	11.7		10.5		8.2	
NEC		0.007***		0.571***		#
Yes	57.1		14.3		-	
No	12.2		11.2		8.8	
Late-onset sepsis*****		<0.0001*		0.019***		0.357***
Yes	19.7		11.8		3.9	
No	3.7		3.7		1.6	
Severe PIVH		0.060***		0.538***		0.172***
Yes	25.0		8.3		8.3	
No	6.6		5.7		0.8	

GA - gestational age, IUGR - intrauterine growth restriction, SGA - small for gestational age, CRIB - Clinical Risk Index for Babies; HMD - hyaline membrane disease, PDA - patent ductus arteriosus, NEC - necrotizing enterocolitis, Severe PIVH - peri-intraventricular hemorrhaging. Results are expressed as numbers (%). The category percentages refer to the total number of valid records and do not consider the missing data. Tests were considered significant if p<0.05. * P value according to Pearson's chi-square test, ** p value according to variance test for linear trends, *** p-value according to Fisher's exact test, **** considering those <1,500 g; ***** excluding those who were discharged or died in the first 48 hours after birth; # unable to test for an association due to a frequency of zero.

Table 5 - Odds ratios of deaths according to the variables included in the bivariate and multivariate logistic regression analysis

Variables	Hospital death * OR (95%CI)	p value	Neonatal death ** OR (95%CI)	p value	Early death *** OR (95%CI)	p value
Antenatal corticosteroids****	---	NS	0.2 (0.1-0.8)	0.028	0.2 (0.1-0.9)	0.048
Late-onset sepsis****	6.5 (2.5-16.6)	<0.001	3.5 (1.3-9.8)	0.016	---	NS
GA <28 weeks	13.3 (5.1-34.6)	<0.0001	11.2 (4.3-29.3)	<0.0001	5.9 (2.1-16.9)	0.001
SGA	8.2 (2.8-23.6)	<0.0001	6.4 (2.1-19.1)	0.001	5.1 (1.5-16.5)	0.007
5-minute Apgar <7	4.8 (1.7-13.6)	0.003	4.1 (1.4–11.6)	0.008	6.9 (2.4-19.8)	<0.0001
NEC	6.6 (1.1-41.7)	0.043	--	NS	--	NS

OR - odds ratio, 95% CI - confidence interval of 95%, GA - gestational age, SGA - small for gestational age; NEC - necrotizing enterocolitis; NS – no significant. * For the outcome "hospital death", the following were included in the multivariate model: GA <28 weeks, SGA, male gender, 5-minute Apgar score <7, HMD, PDA and NEC (severe PIVH was excluded as a confounding factor). ** For the outcome "neonatal death", the following were included in the multivariate model: GA <28 weeks, SGA, 5-minute Apgar score <7 (HMD was excluded as a confounding factor). *** For the outcome "early death," the following were included in the multivariate model: GA <28 weeks, SGA, 5-minute Apgar score <7 and HMD (severe PIVH was excluded as a confounding factor). **** The bivariate logistic regression was performed given the difference between study subpopulations.

DISCUSSION

Increased access to supplementary exams (TFUS and DEcho) and higher rates of breastfeeding at discharge were shown to be indicators of improved care provided to premature infants in the unit studied. Mortality was inversely correlated with GA. The deaths of premature infants and their concentration in the neonatal period, especially in the early neonatal period, were associated with extreme prematurity, SGA at birth and a 5-minute Apgar score <7. In the post-neonatal period, mortality was also associated with NEC. Late-onset sepsis was associated with hospital and neonatal death, and antenatal corticosteroids were shown to be protective against neonatal and early deaths.

In this study, the increased participation of mothers from other municipalities was explained by the characteristics of the micro-region referral unit. The maternal and gestational ages, incidence of twins and delivery method were similar to the literature.[2,17,27,36] However, maternal illnesses and IUGR may have been influenced by incomplete data in the patients' records.

The record of at least one prenatal consultation in 2010 (95.2%) was found to exceed the results of the Brazilian Neonatal Research Network (Rede Brasileira de Pesquisas Neonatais – RBPN) in the same year (91%).[16] However, It was difficult to determine whether the data for previous years were influenced by inadequate recording of medical records or whether pregnant women had better access to the consultation services.

The low rate of antenatal corticosteroid use (39.2%), although well below the RBPN (70%)[16] and the National Institute of Child and Human Development (NICHD) data (79%),[28] was consistent with studies in Brazil that do not participate in neonatal research networks (30%).[15,37,38] The values of the first years that were assessed may suffer from inadequate medical records. However, in 2010, the NICU established a strategy to increase the use of antenatal corticosteroids, suggesting they be prescribed when indicated, upon receiving the request for a vacancy for the pregnant woman.

The premature SGA, which corresponded to 11.3%, contrasted with other studies in Brazil (25.7 to 47.8%)[2,15,37,38] and the NICHD (16%).[39] However, the proportion of SGA infants depends on the BW curve used as a reference, and these curves have distinct results, depending on the characteristics of the population.[40]

The prevalence of HMD, BPD, late-onset sepsis and 5-minute Apgar <7 were consistent with other studies,[17,28] despite the variability of the reports in the literature, particularly regarding late-onset sepsis, the results of which range from 22%[28] to 71.9%.[15-17,37,38] It is sometimes difficult to differentiate between NEC and late-onset sepsis in the medical records. The levels of PDA were lower than those observed in other studies, and severe PIVH was comparable to the data in the literature, noting that both may have been influenced in the period prior to the acquisition of a portable ultrasound.[16,17,20,28] The length of hospital stay in this study resembled that reported in the literature, which reported even longer hospital stays for a lower GA.[15,38]

It is worth noting that beginning the human breast milk bank, which reinforced the implementation of the Kangaroo method in 2009, had a positive impact on breastfeeding at discharge from the NICU in 2010 (50.6%). The literature reports that breastfeeding rates range from 48 to 73%.[34,38] Therefore, a Kangaroo Unit should be created, which could greatly increase the rates of breastfeeding at discharge and could be established as a strategy of qualification of neonatal care.[41-44]

Upon analyzing mortality, the study's survival rate (86.7%) was comparable to the RBPN and NICHD results, the values of which varied from 71% to 86%.[16,17,28] The association between decreased survival and the decrease in the GA has also been reported by other researchers.[14,45-48] The concentration of deaths in the early neonatal period, an outcome for which the extremely premature infants contribute considerably, is consistent with the literature. Therefore, these data are extremely relevant in implementing strategies aimed at reducing infant mortality.[2,48]

The use of antenatal corticosteroids by pregnant women <35 gestational weeks acted as a protective factor against neonatal mortality and its early component in this study, which has also been reported by other studies.[2,16,28,36] Therefore, the appropriate use of these steroids can have an impact on reducing child mortality, especially its early component, which is strongly influenced by perinatal causes and prematurity.[3-7]

In this study, SGA at birth was associated with increased odds of neonatal death and its early component, a fact confirmed by Larroque et al.[45] but which contrasts with the results reported by the RBPN.[2,17] The association between a 5-minute Apgar score <7 and neonatal death and its early component was also consistent with other studies. This score reflects the conditions of the premature infant at birth and is closely related to the perinatal period.[14,48,49] Although there was no association between the severity of the premature infant at admission as assessed by the CRIB score and an increased chance of death, such results have been reported by other researchers.[26,50] The associations between neonatal sepsis, NEC and death have been corroborated by several studies.[2,28,48,51]

Although the results are consistent with the reality in Brazil,

the study emphasizes the need for urgent implementation of strategies for promoting breastfeeding and reducing neonatal mortality and its early component. Thus, the findings of this study should guide the implementation of effective interventions aimed at promoting breastfeeding (i.e., creation of a Kangaroo Unit) and improving the quality of prenatal and perinatal care by using antenatal corticosteroids (when indicated), controlling for factors that lead to premature birth and SGA at birth, providing better birthing conditions and controlling risk factors for sepsis.

The retrospective characteristic of this study, which is a limitation, is subjected to bias in the information (medical records). However, the results are similar to those reported by other researchers and provide guidance for interventions aimed at improving the indicators of care provided to pregnant women and premature infants at all levels of health care. It is also necessary to reevaluate the indicators, interventions and outcomes continuously to realign those actions.

CONCLUSIONS

Increased access to supplementary exams (TFUS and DEcho) and the increased rates of breastfeeding at discharge were shown to be indicators of the improved care provided to premature infants. The deaths of premature infants and their concentration in the neonatal period, particularly in the early neonatal period, were associated with extreme prematurity, SGA at birth and a 5-minute Apgar score <7. In the post-neonatal period, mortality was also associated with NEC. Late-onset sepsis was associated with hospital and neonatal deaths, and antenatal corticosteroids were demonstrated to be protective against neonatal and early deaths.

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RESUMO

Objetivo: Analisar o processo da assistência prestada aos prematuros atendidos em uma unidade de terapia intensiva neonatal e os fatores associados à sua mortalidade.

Métodos: Estudo transversal de dados retrospectivos de prematuros de uma unidade de terapia intensiva no triênio 2008-2010. Descreveram-se características maternas e dos prematuros e realizou-se análise bivariada entre estas, o período de estudo e o desfecho "óbito" (hospitalar, neonatal e precoce) pelos testes do qui-quadrado de Pearson, exato de Fisher ou qui-quadrado de tendência linear. Aplicou-se a regressão logística bivariada e multivariável pelo método *Stepwise Backward LR* entre as variáveis com p<0,20 e o desfecho "óbito". Considerou-se significante p<0,05.

Resultados: Estudaram-se 293 prematuros. Os incrementos do acesso aos exames complementares (ultrassonografia transfontanelar e ecodoplercardiograma) e das taxas de aleitamento materno foram indicadores de melhoria da assistência. A mortalidade concentrada no período neonatal, especialmente no neonatal precoce, associou-se à prematuridade extrema, ao nascimento pequeno para idade gestacional e a Apgar <7 no 5º minuto de vida. A sepse tardia também associou-se à maior chance de óbitos neonatais e o corticoide antenatal mostrou-se protetor para os óbitos neonatais e precoces.

Conclusões: Apesar dos resultados comparáveis à realidade brasileira, o estudo enfatiza a necessária implementação de estratégias para promoção do aleitamento materno e para redução da mortalidade neonatal e de seu componente precoce.

Descritores: Prematuro; Aleitamento materno; Assistência perinatal; Mortalidade neonatal precoce; Mortalidade neonatal; Sepse; Terapia intensiva neonatal

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