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LIMIT OF VIABILITY OF EXTREMELY PRETERM INFANTS TREATED AT A UNIVERSITY HOSPITAL

Limite de viabilidade de prematuros extremos atendidos em um hospital universitário

Límite de viabilidad de prematuros extremos atendidos en un hospital universitario

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ABSTRACT

Objective: to describe the profile of newborns with extreme prematurity and to identify factors associated with mortality according to gestational age and their limit of viability. **Method:** a retrospective observational study, with a quantitative approach, carried out in a university hospital in the state of Minas Gerais, developed from August 2021 to January 2022. The sample consisted of 39 records of live-born extreme preterm infants. Descriptive analysis of quantitative variables was performed using measures such as mean, standard deviation and minimum and maximum values. Categorical variables were described from their absolute and percentage frequency distributions. **Results:** most pregnant women are young-adult women, who underwent prenatal care and cesarean delivery. Of the preterm infants, the male sex prevails, with a gestational age of 25 weeks, most of whom died at a gestational age of 23 and 24 weeks. **Conclusion:** the limit of viability in this service is at a gestational age equal to or greater than 25 weeks.

DESCRIPTORS: Neonatal mortality; Extreme premature mortality; Profile of newborns.

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RESUMO

Objetivo: descrever o perfil de recém-nascidos com prematuridade extrema e identificar fatores associados a mortalidade segundo idade gestacional e o limite de viabilidade destes. **Método:** estudo observacional retrospectivo, com abordagem quantitativa, realizado em um hospital universitário do estado de Minas Gerais, desenvolvido de agosto de 2021 a janeiro de 2022. A amostra foi composta por 39 prontuários de prematuros extremos nascidos vivos. Foi realizada a análise descritiva das variáveis quantitativas usando medidas como média, desvio-padrão e valores mínimo e máximo. As variáveis categóricas foram descritas a partir de suas distribuições de frequência absoluta e percentual. **Resultados:** a maioria das gestantes são mulheres adultos-jovens, realizaram pré-natal e parto cesárea. Dos prematuros prevalece sexo masculino, idade gestacional de 25 semanas, evoluíram para óbito a maioria destes com idade gestacional de 23 e 24 semanas. **Conclusão:** o limite de viabilidade nesse serviço situa-se em uma idade gestacional igual ou maior que 25 semanas.

DESCRITORES: Mortalidade neonatal; Mortalidade prematuros extremos; Perfil dos recém-nascidos.

RESUMEN

Objetivo: describir el perfil de los recién nacidos con prematuridad extrema e identificar los factores asociados a la mortalidad según la edad gestacional y su límite de viabilidad. **Método:** estudio observacional retrospectivo, con abordaje cuantitativo, realizado en un hospital universitario del estado de Minas Gerais, desarrollado entre agosto de 2021 y enero de 2022. La muestra estuvo compuesta por 39 prontuarios de prematuros extremos nacidos vivos. El análisis descriptivo de las variables cuantitativas se realizó utilizando medidas como la media, la desviación estándar y los valores mínimo y máximo. Las variables categóricas se describieron a partir de sus distribuciones de frecuencia absoluta y porcentual. **Resultados:** la mayoría de las gestantes son mujeres adultas jóvenes, que realizaron control prenatal y parto por cesárea. De los prematuros prevalece el sexo masculino, con una edad gestacional de 25 semanas, la mayoría de los cuales fallecieron a las 23 y 24 semanas de edad gestacional. **Conclusión:** el límite de viabilidad en este servicio es a una edad gestacional igual o mayor a 25 semanas.

DESCRIPTORES: Mortalidad neonatal; Mortalidad prematura extrema; Perfil del recién nacido.

INTRODUCTION

Annually, about 15 million preterm newborns (PN) are born worldwide,[1] in Brazil the prematurity rate is estimated at 11.5% of total births, about 345,000 children out of approximately 3,000,000 births.[2] In 2016, in the country 315,831 newborns presented gestational age (GA) < 37 weeks, being 43,233 between 22 – to 31 weeks and 40,453 with birth weight (BW) < 1,500g.[3]

Extreme preterm infants are those born with a gestational age (GA) < 28 weeks, and that after birth require immediate intervention in neonatal resuscitation, ventilatory support and a trained and skilled team, a pediatrician with specialty in neonatology, able to perform intubation, indicate cardiac massage and medications.[3-4]

The need for neonatal resuscitation procedures and respiratory assistance can be predicted by the presence of maternal diseases related to pregnancy such as gestational diabetes, pre-eclampsia, still during prenatal care, and obstetric complications such as fetal breech presentation, umbilical cord prolapse, prolonged labor, and premature rupture of membranes.

Prematurity was the leading cause of death in children under five years between the years 1990 and 2015,[5] in addition to low birth weight the respiratory distress associated, prematurity.[6] Extreme PNs with 25 or more weeks GA have better survival rates when compared to those with less than 24 weeks GA, in a large proportion without severe sequelae; however, when the extreme PNs are born before 24 weeks GA, these rates decrease considerably due to immaturity, even when neonatal resuscitation maneuvers and respiratory assistance are applied.[6] Care to these PNs should promote comfort and support to mother, father, and family.[3]

Survival and prognosis of those born between 22 and 24 weeks are uncertain, they are in the "gray zone", where there are still many doubts about what are the best conducts to be adopted and what is the degree of investment and intervention to be performed.[3] Therefore, the decision not to start neonatal resuscitation in this age group or to stop the maneuvers in the delivery room is a controversial issue, since they also depend on the national, social, cultural and religious context, in which concepts of morality and ethics are discussed.[3]

The limit of viability has been between 22 and 28 weeks GA, however, it may change according to advances in technology and treatment of premature infants, since it depends on perinatal care of the delivery site and the ethical issues surrounding it.[7] Each service should establish its limit of viability, considering the ability to maintain an extreme PNs with quality of life.[4]

To assess what determines neonatal mortality, it is important to know and monitor the factors that cause it, identify vulnerable groups, the different risk variables and the relationship with the progression to death, assisting in devices that bar this process since the prenatal period.[6]

In view of this, and understanding that the adoption of protocols based on the best evidence is fundamental to guide health professionals in the implementation of good practices in neonatal care, this study aimed to describe the profile of newborns with

extreme prematurity and to identify factors associated with mortality according to gestational age and the limit of their viability.

METHODS

This was a retrospective observational study, with a quantitative approach, carried out at a teaching hospital in the state of Minas Gerais, using the medical records of live born extreme premature newborns, guided by the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) of the EQUATOR network.

The inclusion criteria adopted were: having a confirmed diagnosis of extreme prematurity that fit the Ministry of Health definition criteria of prematurity <28 weeks,[P9] having been born alive in that hospital in the period from January 2015 to January 2020, and the medical records being located in the Medical Archives Service (SAME).

Data collection occurred in the period from August 2021 to January 2022, the variables researched were origin, age, maternal level of education, type of delivery, prenatal care, pre-existing disease, drug use and diseases associated with pregnancy and childbirth; the variables related to RN: gender, APGAR index, birth weight, gestational age, twin birth, presence of congenital malformations; and the variables related to hospitalization: referral site, intercurrences (neonatal resuscitation maneuvers, need for vasoactive drugs, HR <60 bpm, meconium amniotic fluid, hypotonia, orotracheal intubation, respiratory distress/ apnea/ gasping) and evolution during hospitalization (intracranial hemorrhage; CA, sepsis, surgical procedures, impaired neuropsychomotor development, problems in cognitive and social skills) finally outcome of hospitalization.

Data from the medical records were entered into an Excel® for Windows® spreadsheet, by double entry for processing and analysis. Then, data were exported to the Statistical Package for the Social Science (SPSS) program, version 23 for Windows® and descriptive analysis of quantitative variables was performed using measures such as mean, standard deviation and minimum and maximum values. Categorical variables were described from their absolute and percentage frequency distributions.

The study complied with the requirements concerning ethical aspects, obeying the guidelines and norms that regulate research involving human beings. It was approved by the Research Ethics Committee of the Universidade Federal do Triângulo Mineiro, under registration CAAE 45775421.5.0000.5154 and opinion number: 4.759.706, on June 08, 2021.

RESULTS

We located and included 85 records of PNs with PN P07.2, corresponding to extreme prematurity, of which 39 met the inclusion criteria.

Maternal and obstetric characteristics showed a predominance of 20 (51.3%) women from the cities of the southern triangle macro-region, mean age of 28.11 years (SD = 7.094), with a minimum of 15 and maximum of 41 years. Of these, 25 (64.1%) had a cesarean delivery, 31 (79.5%) had prenatal care in progress, four (10.3%) had pre-existing diseases and three (7.7%) were drug users. Regarding education, in 20 (51.3%) records this information was ignored, seven (17.9%) had completed elementary school and six (15.4%) incomplete.

Of the mothers, 27 (69.2%) had diseases associated with pregnancy and delivery, 11 (28.2%) had premature labor, five (12.8%) had chorioamnionitis, and how many (10.3%) had Hyaline Membrane Disease (HMD) (Table 1).

Of the variables related to the extreme PNs it was identified that 23 (59%) were male, with a mean APGAR at the 1st minute of life of 5.66 (SD = 2.209) ranging from a minimum value of 1 to a maximum of 9, the APGAR at the 5th minute of life had a

Table 1 – Profile of extreme PNs classified according to variables related to hospitalization. Uberaba, MG, Brazil, 2022 (n=39)

Variables	23 a 24 n(%)	25 a 28 n(%)	Total n(%)
Pathologies associated with pregnancy			
PL	7(41,2%)	4(18,2%)	11(28,2%)
Coroamnionitis	1(5,9%)	4(18,2%)	5(12,8%)
Hyaline membrane disease (HMD)	2(11,8)	2(9,1)	4(10,3%)
Gestational Age	17(43,58)	22(56,41)	39(100%)
Twinning	5 (29,4%)	2 (9,1%)	7(17,9%)
Malformation	1(5,9%)	0	1(2,6%)
HR <60 bpm	0	4(18,2%)	4(10,3)
meconium amniotic fluid	0	1(4,5%)	1(2,6%)
Hypotonia	9(52,9%)	8(36,4%)	17(43,6%)
Respiratory discomfort	17(43,58)	22(56,41)	39(100%)
Central Cyanosis	1(5,9%)	1(4,5%)	2(5,1%)
Acrocyanosis	0	1(4,5%)	1(2,6%)
Cord prolapse	1(5,9%)	0	1(2,6%)
Resuscitation maneuvers	17(43,5%)	22(56,4%)	39(100%)
Use of vasoactive drugs	1(5,9%)	5(22,7%)	6(15,4%)

Table 1 – Cont.

Orotracheal intubation	16(94,1%)	21(95,5%)	37(94,9%)
PPV	14(82,4%)	15(68,2%)	29(74,4%)
Evolution during hospitalization			
Sepsis	12(70,6%)	14(63,6%)	26(66,7%)
Shock	10(58,8%)	9(40,9%)	19(48,7%)
Problems in neuropsychomotor development	2(11,8%)	9(40,9%)	11(28,2%)
Problems with cognitive skillss	1(5,9%)	8(36,4%)	9(23,1%)
High	2(11,8%)	12(54,5%)	14(35,9%)
Death	15(94,1%)	10(45,5%)	25(64,1%)

Source: Prepared by the author, 2022.
Legend: PPV: Positive pressure ventilation.

mean of 7.68 (SD = 1.3671) ranging with a minimum index of 4 and a maximum of 10; The mean birth weight was 708 grams (SD = 179.28) being 390 grams the minimum weight and 1170 kilograms the maximum weight, the mean GA was 25 weeks (SD = 1.375), varying with minimum of 23 weeks and maximum of 27 weeks and the most frequent GA was 25 to 28 weeks, present in 22 (56.41%) newborns. Seven (17.9%) were twins, five (29.4%) with a GA of 23 and 24 weeks, and one (2.6%) had congenital malformation.

After birth, 36 (92.3%) were referred to the Neonatal Intensive Care Unit (NICU), two (5.1%) to the Infant Emergency Room (ISP) and one (2.6%) to the Neonatal Intermediate Care Unit (NICU).

All extreme PNs had complications in the delivery room, requiring some resuscitation maneuver, six (15.4%) required vasoactive drugs, four (10.3%) had heart rate (HR) >60 beats per minute (bpm), one (2.6%) had meconium amniotic fluid and 17 (43.6%) had hypotonia. All 39 extreme PNs who presented respiratory distress, 29 (74.4%) underwent positive pressure ventilation and 37 (94.9%) underwent orotracheal intubation (OTI) (Table 1).

During hospitalization 26 (66.7%) developed sepsis, 19 (48.7%) had shock, 11 (28.2%) had problems in neuropsychomotor development, and nine (23.1%) had problems in cognitive and social skills (Table 1).

Of the 39 PNs, 25 (64.1%) died; of these, 18 (72.0%) mothers had pathologies associated with pregnancy and delivery. Of the

Table 2 – Profile of extreme preterm infants who died. Uberaba, MG, Brazil, 2022 (n = 25)

Variables related to PNs who died	**23 a 24 n(%)**	**25 a 28 n(%)**
PPV	12(80%)	7(70%)
Variables related to PNs who died	14(93,3%)	9(90%)
Hypotonia	9(60%)	4(40%)
HR >60bpm	0	3(30%)
Need for vasoactive drugs	0	2(20%)
Sepsis	11(73,3%)	5(50%)
Shock	10(66,7%)	4(40%)
Pneumothorax	4(26,7%)	0
Total	15	10(100%)
Variables related to PNs who were discharged	23 a 24 n(%)	25 a 28 n(%)
Pathologies associated with pregnancy and childbirth	1(50%)	
PPV	2(100%)	8(66,7%)
Orotracheal intubation	2(100%)	12(100%)
Hypotonia	0	4(33,3%)
HR >60bpm	0	1(8,3%)
Need for vasoactive drugs	1(50%)	3(25%)
Evolution during hospitalization		
Sepsis	1(50%)	9(75%)
Shock	0	5(41,7%)
Pneumothorax	0	3(25%)
Problems in neuropsychomotor development	0	6(50%)
Problems with cognitive and social skills	0	6(50%)
Total	2(100%)	12(100%)

Source: Prepared by the author, 2022.
Legend: PPV: Positive pressure ventilation.

PNs who died, 15 (88.2%) had a GA of 23 and 24 weeks and 10 (45.5%) had between 25 and 28 weeks.

When we analyzed the PNs who died at 23 and 24 weeks, we identified that 12 (80.0%) required positive pressure ventilation, 14 (93.3%) required OTI and nine (60.0%) had hypotonia. During hospitalization, 11 (73.3%) had sepsis, ten (66.7%) had shock, and four (26.7%) developed pneumothorax (Table 2).

Among the extreme PNs who died with GA between 25 and 28 weeks, nine (90.0%) required OTI, seven (70.0%) required positive pressure ventilation, four (40.0%) had hypotonia, three (30.0%) had HR<60 bpm and two (20.0%) required vasoactive drugs. During hospitalization, five (50.0%) had sepsis and four (40.0%) had shock (Table 2).

Fourteen (35.8%) extreme PNs were discharged, and 12 (54.5%) were born at 25 to 28 weeks. All required OTI, eight (66.7%) required PPV, nine (75.0%) had sepsis, five (41.7%) had shock, six (50.0%) had impaired neuropsychomotor development and problems with cognitive and social skills (Table 2).

DISCUSSION

The present study made it possible to describe the profile of extreme PNs born at the University Hospital of the South Triangle Macroregion and to identify the profile of those who died and their limit of viability.

Regarding the maternal variables, the mean age in this study was 28 years, suggesting that they are young adult women of childbearing age, corroborating the results of other studies of mothers of PNs.[8-10] Of the 19 records with information on the level of schooling, complete secondary education was the most frequent. The results of this study identified that most mothers had prenatal care; however, the number of consultations performed by pregnant women was not presented, and it was not possible to identify the adherence to prenatal care.

The most frequent type of delivery was the Cesarean section, corroborating the results of other studies.[9,11-13] Cesarean delivery has a protective effect for neonatal death in extremely low birth weight preterm infants.[14] In the present study, PTE was the most frequent pregnancy-related pathology, followed by chorioamnionitis, which is associated with deaths due to infection in PNs.

The majority of PNs were male, corroborating the results of other studies.13,15-16 Male PNs have later lung maturation compared to females, and are more likely to develop respiratory problems favoring mortality in this age group.[15]

The mean APGAR at the 5th minute of life was 7.6, the mean weight was 708g and the mean GA was 25 weeks, values that are close to the study on mortality in PNs.[17] The apgar index is an indicator of adaptation to extrauterine life and of oxygenation in the antepartum and intrapartum period and also assesses fetal vitality and the NB's initial prognosis.[17] Several studies show that low apgar index, lower GA and lower BW are linked to neonatal mortality.[10,13,17-19]

All 39 NB in this study received resuscitation maneuvers, were referred to another sector alive and received specific and necessary treatment for improvement and maintenance of clinical status, similar results were identified in a study on the characterization of preterm infants.[13]

The interval between 23 and 24 weeks of gestational age is called the gray zone because there are not enough factors to determine a survival prognosis; the decision to resuscitate or not these premature babies depends on the parents' wishes.[20] There were no records on this aspect in the medical charts.

The respiratory distress present in all PNs is justified by the fact that the anatomical maturation and function of the lungs requires at least 35 weeks of gestation,[17] leading to the need for PPV and orotracheal intubation of PNs in this study.

During hospitalization most of the PNs in this study had neonatal sepsis and secondarily shock, similar results were found in another study where the proportion of sepsis was 61% followed by cardiogenic shock,[19] sepsis is related to neonatal death.[16,19] The prevalent outcome was death in 25 PNs, among them most had GA of 23 and 24 weeks and developed neonatal sepsis. Sepsis should be a cause for concern in NICUs because of its association with invasive procedures.[16]

It was observed that discharges were prevalent in PNs aged 25 to 28 weeks, and of the 12 who received discharges, six had impaired neuropsychomotor development and/or problems with cognitive and social skills. These changes are justified by the fact that immature organ systems common at birth may lead to difficulties in adapting to different environmental stimuli, increasing the chances of the preterm infant presenting neurological disorders.[9]

The highest frequency of survival of PNs is among those born above 25 weeks or more of GA. This is inconsistent with the results of a study conducted in the United States (USA), which defined the viability of PNs between 20 and 25 weeks. The GA continues to be the determining factor on the limit of viability, since no precise factors on the prognosis of extreme PNs have been identified..[20]

CONCLUSION

It was concluded that the mothers of PNs were young, with low education, had prenatal care, however it was not possible to identify the number of consultations, and there was a predominance of Cesarean delivery, PL and chorioaminionitis as pathologies associated with pregnancy and delivery. The extreme PNs born during the study period were male, predominantly with a GA of 25 weeks, were referred to the NICU, presented respiratory distress, required neonatal resuscitation maneuvers and OTI, and during hospitalization developed neonatal sepsis, most died, and were between 23 to 24 weeks. It is concluded that the limit of viability in this service is at a GA of 25 weeks or more.

The study was conducted using secondary data from medical records the incompleteness of data compromised the analysis of some results as the level of education, adherence to prenatal care and the willingness of parents to perform measures to maintain the life of the extreme PNs.

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