

ORIGINAL ARTICLE

Following the very low birth weight infant at one year of age

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ABSTRACT

Introduction: advances in perinatal care have allowed greater survival of very low birth weight newborns (less than 1 500 grams) susceptible to diseases that impair their growth and development.

Objective: to describe some variables related to growth and development at one year of corrected age of very low birth weight newborns attended at the Neonatal Care Service in Villa Clara between July 2018 and July 2019 who survived.

Methods: a prospective longitudinal descriptive study was conducted at the “Mariana Grajales” Hospital in Santa Clara City. The sample consisted of 45 patients who attended uninterruptedly to the follow-up consultation of at-risk infants performed at the institution. A form was prepared for the collection of primary data which included qualitative and quantitative variables that were tabulated; tables and graphs were prepared.

Results: it was found that at one year of age corrected according to the reference tables, almost half of the children did not have adequate weight compared to non-risk patients and others had low height and head circumference lower (or both) than the corresponding height. More than one third of the total had some degree of malnutrition, less than one percent of the children had delayed psychomotor development and the majority had delayed tooth eruption.

Conclusions: at one year of corrected age, most of the very low birth weight newborns had some degree of growth and developmental delay.

Key words: very low birth weight newborn; growth, psychomotor development

RESUMEN

Introducción: los avances en la atención perinatal han permitido una mayor sobrevivencia de recién nacidos de muy bajo peso (menor de 1 500 gramos) susceptibles a enfermedades que merman su crecimiento y su desarrollo.

Objetivo: describir algunas variables relacionadas con el crecimiento y el desarrollo al año de edad corregida de los nacidos con muy bajo peso atendidos en el Servicio de Cuidados Neonatales en Villa Clara entre julio de 2018 y julio de 2019 que sobrevivieron.

Métodos: se realizó un estudio descriptivo longitudinal prospectivo en el Hospital "Mariana Grajales" de la Ciudad de Santa Clara. La muestra fue de 45 pacientes que acudieron de manera ininterrumpida a la consulta de seguimiento de los infantes de riesgo realizada en la institución. Se confeccionó un formulario para la recolección del dato primario que incluyó variables cualitativas y cuantitativas que fueron tabuladas; se confeccionaron tablas y gráficos.

Resultados: se obtuvo que al año de edad corregida según las tablas de referencia casi la mitad de los niños no tenían el peso adecuado comparado con pacientes sin riesgo y otros presentaban baja talla y circunferencia cefálica inferior (o ambas) a la de correspondencia. Más de un tercio del total tenían algún grado de desnutrición, menor por ciento de niños con retardo del desarrollo psicomotor y la mayoría con retraso del brote dentario.

Conclusiones: al año de edad corregida la mayoría de los recién nacidos de muy bajo peso al nacer presentaban algún grado de retraso en el crecimiento y el desarrollo.

Palabras clave: recién nacido de muy bajo peso; crecimiento; desarrollo psicomotor

INTRODUCTION

In recent decades, numerous changes and transformations have taken place in Cuba that have raised the standard of living of the population.⁽¹⁾ The National Health System is one of the sectors that has received most support from the State, which has invested substantial material and human resources in it, as evidenced by the decrease in infant mortality rates, which places Cuba at the level of developed countries.⁽²⁾

Among the advances achieved are the programs for the care of children and women of childbearing age, the program to reduce low birth weight as a risk factor for morbidity and mortality throughout life, and the screening and control of preconception risk, among others, which have contributed to the reduction of low birth weight.⁽³⁾

According to the World Health Organization (WHO), it is estimated that more than 20 million children are born with this condition annually (more than 28% are estimated to occur in South Asia and more than 25% in Africa). In contrast, low birth weight in industrialized countries averages 6%, similar to that of East Asia and the Pacific; Latin America and the Caribbean have 9%.^(4,5)

In Cuba, the incidence of very low birth weight newborns (VLBW) has increased slightly, but does not exceed 1% of the total number of live births in the last 15 years, while extreme birth weight is only 0.2 to 0.3% of the total; however, their survival rate has increased to over 85%.⁽⁶⁾

The province of Villa Clara is not exempt from the national and international problems, the index of low birth weight has decreased in the last years, but not that of very low birth weight, which has an average incidence in the last years of 0.5% of the total of live births, with a general survival of more than 88%. This special group of patients require differentiated attention, demand individualized forms of follow-up, cause high economic costs for survival, suffer long-term morbidities that include cerebral palsy, mental retardation, poor school performance, growth deficit and increased respiratory morbidity, and generate family and social problems.⁽⁷⁾

This study was carried out to describe some variables related to growth and development at one year of corrected age of very low birth weight newborns

who survived and were attended at the Neonatal Special Care Service of the "Mariana Grajales" Hospital born in the period of one year.

METHODS

A prospective longitudinal descriptive study was carried out in the Neonatal Special Care Service of the "Mariana Grajales" Gynecology and Obstetrics University Hospital of Santa Clara City, Villa Clara Province, during 2018 and 2019.

The study universe, coinciding with the probabilistic sample, included the total number of very low birth weight newborns (less than 1 500 grams) attended at the Service between July 2018 and July 2019 who survived to one year of corrected age and attended uninterruptedly the follow-up consultation of at-risk infants performed by qualified professionals at the Hospital; no exclusion criteria were considered.

The patients were followed up during their first year of life (considering corrected postnatal age) in a centralized consultation, which is periodically performed at the Hospital.

SPSS version 21.0 for Windows was used for the statistical analysis of the data. Absolute and relative frequency distribution tables were drawn up and descriptive statistical techniques were applied according to the level of measurement of the variables.

To measure the association between two variables measured on an ordinal scale, the Spearman rank correlation coefficient (Rho) was used, which takes values between -1 (perfect negative) and 1 (positively perfect).

Values close to 1 represent a strong correlation between the variables, while values close to zero represent a weak correlation. When the coefficient is equal to zero, it means that there is no association between the variables. Only correlations that were significant ($p < 0.05$) were expressed.

RESULTS

At one year of corrected age, the nutritional assessment was observed. In general, only 46.6% of the patients had an adequate weight at one year of corrected age and, in particular by weight subgroups, all the children (four) with a birth weight of less than 1,000 grams were classified as underweight or thin, and of those in the range between 1,000 and 1,249 grams at birth, five infants were classified as follows: one child (10%) as underweight and four children (40%) as thin (Table 1). As birth weight increased, the incidence of undernutrition decreased, which was statistically significant.

Table 1. Weight at birth and at one year of age

Birth weight (grams)	Weight at one year of age							
	Underweight		Thin		Normal weight		Total	
	No.	%	No.	%	No.	%	No.	%
< 1 000	3	75.0	1	25.0	0	0.00	4	8.9
1 000 - 1 249	1	10.0	4	40.0	5	50.0	10	22.2
1 250 - 1 499	8	25.8	7	22.6	16	51.6	31	68.9
Total	12	26.7	12	26.7	21	46.6	45	100

Spearman's Rho=0.415; $p=0.05$

In relation to height-for-age, the behavior was similar to weight at one year of age corrected (Table 2). In 100% of the children under 1,000 grams at birth, the height for age did not correspond, 50% of those between 1,000 and 1,249 grams were undersized and only 38.7% of those included in the subgroup of 1,250 to 1,499 grams did not reach the corresponding height when compared to children without risk at birth.

This variable was also statistically significant ($p < 0.05$).

Table 2. Birth weight and height at one year of age

Weight at birth (grams)	Size at one year of age					
	Low height		Normal size		Total	
	No.	%	No.	%	No.	%
< 1 000	4	100	0	0.00	4	8.9
1 000 - 1 249	5	50.0	5	50.0	10	22.2
1 250 - 1 499	12	38.7	19	61.3	31	68.9
Total	21	46.7	24	53.3	45	100

Spearman's Rho =0.467; $p=0.01$

After correlating weight and height, according to sex and the Cuban Nutrition Tables, 60% of the patients included in the study were found to be eutrophic. Fifty percent of those under 1,000 grams at birth and 20% of those weighing between 1,000 and 1,249 grams were categorized as malnourished. From the nutritional point of view, only 58% (18 patients), between 1,250 and 1,499 grams birth weight, achieved an adequate relationship between weight and height according to sex at one year of life (Table 3).

The correlation between both variables was not demonstrated, that is, the nutritional evaluation at one year of age was not statistically related to birth weight ($p > 0.05$).

Table 3. Nutritional evaluation at one year of age (weight/height)

Birth Weight (grams)	Nutritional evaluation at one year of age							
	Undernourished		Thin		Eutrophic		Total	
	No.	%	No.	%	No.	%	No.	%
< 1 000	2	50.0	1	25.0	1	25.0	4	8.9
1 000 - 1 249	2	20.0	0	0.00	8	80.0	10	22.2
1 250 - 1 499	6	19.4	7	22.6	18	58.0	31	68.9
Total	10	22.2	8	17.8	27	60.0	45	100

Spearman's Rho=0.019; $p=0.90$

The 68.9% of the infants had normal psychomotor development when applying the test proposed by the Iberoamerican Society of Neonatology (Table 4), but at the expense of those with higher birth weight, because 50% of the infants weighing less than 1250 grams were categorized as retarded.

Table 4. Psychomotor development at one year of age

Weight at birth (grams)	Psychomotor development					
	Retarded		Normal		Total	
	No.	%	No.	%	No.	%
< 1 000	2	50.0	2	50.0	4	8.9
1 000 - 1 249	5	50.0	5	50.0	10	22.2
1 250 - 1 499	7	22.6	24	77.4	31	68.9
Total	14	31.1	31	68.9	45	100

The categories outside the range of normality selected for this study in the group of patients under 1,500 grams at birth at one year of corrected age, and compared with tables and algorithms of selected references for children without apparent risk, include: delayed dental development (95.6% of patients), low weight for age (53.4%) and height and head circumference at one year of age (46.7% for both) -Table 5-.

Forty percent of the patients had some degree of malnutrition at one year of corrected age.

Table 5. Selected categories at one year of age

Variables	No.	%
Retarded dental development	43	95.6
Low weight for age	24	53.4
Low height for age	21	46.7
Malnourished (weight/height)	18	40.0
Decreased head circumference	21	46.7
Retarded psychomotor development	14	31.1
Ophthalmologic alterations	3	7.1
Mild hearing loss	3	7.1

DISCUSSION

There are many articles published internationally in the consulted literature that address the topic selected for this research, related to evaluations and assessments of very low birth weight newborns in the medium and long term; however, the presence of this topic in national academic publications was almost null in the literature search.^(7,8)

Thanks to the improvement of pre- and perinatal care techniques, greater survival has been achieved in premature patients with increasingly lower gestational ages, but their degree of immaturity makes them susceptible to the development of diseases in the different systems and comorbidities that impair their growth and development and affect their quality of life in the short, medium and long term.⁽⁹⁾

It is extremely difficult to determine in early childhood whether the problems are transitory or whether they reflect the onset of a permanent disability, which corroborates the need for longitudinal follow-up, the more years the better, even into adolescence.⁽¹⁰⁾

At the level of growth and development and anthropometric measurements, a descriptive study entitled "Longitudinal evolutionary study (from birth to eight years of age) of anthropometric variables in a cohort of very low birth weight infants" showed that of the 170 infants studied, 87.1% showed catch-up growth that allowed reaching a normal height at four years of age, but at eight years of age, 8.9% of this group did not show catch-up growth; the possibility of treatment with growth hormone was not considered.⁽¹¹⁾

In this investigation, height recovery at one year of age is reported in 53.3% of the infants examined.

The energy needs of preterm infants are high and increase as body weight decreases; for this reason, optimal caloric intake is important as a guarantee of later development. A search made it possible to select 79 studies that met the selection criteria: it is a subject that has been widely discussed in the

literature, its frequency in studies referring to short-term nutrition of preterm infants is noted, and the direct relationship between nutritional intake and growth in length of preterm infants is evident.⁽¹²⁾

Adequate nutrition of the preterm newborn has positive effects on growth and neurodevelopment. It has been established that the higher the protein and lipid intake, the greater the height of preterm infants, but not the body weight. Studies show the beneficial effect of breast milk on the brain, retina and arterial vessels, but a negative correlation between adiposity and brain volume.⁽¹²⁾ Both WHO and the American Academy of Pediatrics established that breastfeeding is the preferred method of feeding low birth weight and high risk babies because it is healthy and promotes the health of all infants.⁽¹³⁾

A Colombian medical publication reflects that 29.8% of newborns were found to be malnourished during the second semester of age-corrected follow-up. It also showed how, despite the recovery of these infants, malnutrition may recur during the follow-up year more easily in this group.⁽¹⁴⁾

The etiology of neurodevelopmental disorders in preterm infants is complex and multifactorial, and is influenced by both genetic and environmental factors.⁽¹⁵⁾

Some research affirms that children with a history of prematurity may present developmental difficulties. In a province in southern Spain, a prospective longitudinal observational analytical study was conducted with a case-control design that included a group of children with a history of prematurity; there were differences both in the verbal area, in which the children improved at five years of age, and in the perceptual-manipulative area, in which the opposite was true.⁽⁸⁾ The results obtained in this study partially coincide.

Another Spanish article described the neurodevelopmental morbidities presented by a sample of 1 202 children born with $\leq 1\ 500$ grams between 1993 and 2011. The most prevalent were learning disorders (34.4% of cases) and attention deficit hyperactivity disorder (31.5%).⁽¹⁶⁾

A study on the impact of premature births on families showed that it is not prematurity per se, but the presence of developmental alterations as a consequence of prematurity, which determines the degree of stress and overload of caregivers.⁽¹⁷⁾

Some Peruvian researchers state that it is essential to compare the nutritional intake of preterm newborns with the growth of their head measured with a sequential recording of head circumference.⁽¹⁸⁾

Some consider that the window to recover growth retardation is usually one year for head circumference and up to three years for height, although there are studies that describe later recoveries.⁽¹⁰⁾ This result was different from the present study in which only 53.3% of the patients had a head circumference within the normal percentiles at one year of age.

The consulted article "Evaluation of very low birth weight ($\leq 1\ 500$ grams) as a risk indicator for sensorineural hearing loss" points out that the percentage of children with the diagnosis of sensorineural hearing loss among newborns with very low birth weight is much higher than expected in the general population; all those diagnosed with this hearing loss (in their casuistry) were premature and, in addition, presented one or two more hearing risk factors associated with very low birth weight.⁽¹⁹⁾

Fernandez and collaborators⁽²⁰⁾ found in their study sensory hypoacusis in 13.68% of patients, 40 times higher than in the general population without risk factors, and an incidence of three to five cases per thousand neonates, results that do not coincide with other studies that show a very low incidence.⁽²¹⁾

In a study conducted in Mexico at one year of birth a group of at-risk neonates showed:

- Axial tomography of the skull: it was normal in 26% of the cases and in 53% cortical atrophy was evidenced.
- Auditory evoked potentials: 73% were normal and 14% were diagnosed with severe hypoacusis.
- Visual evoked potentials: 70% were normal and 16% had severe visual dysfunction.
- Functional evaluation at one year of life: 50% had upper motor neuron syndrome and 23% had epilepsy.⁽²²⁾

In the article "Seguimiento tras el alta del recién nacido pretérmino con un peso al nacimiento inferior a 1 500 gramos" it is reported that deafness is present in approximately 0.4% of ELBW infants, which differs from the results of this study; in recent years, with the treatment of severe retinopathy by laser photocoagulation, blindness has been reduced to zero percent.⁽²³⁾

Dental eruption is an important part of an individual's development and can be altered by the influence of different factors. Some authors⁽²⁴⁾ consider an adequate tooth eruption when at least eight teeth are present at one year of age, an aspect that did not coincide in the patients included in this study.

In relation to this, alterations in tooth eruption, maxillary hypoplasia, ogival palate, dental malposition and malocclusion are frequently cited.⁽¹⁰⁾ This criterion coincides with those of a study that indicates that there is a frequent delay in the eruption and growth of the primary dentition, consistent with the results obtained by this researcher.⁽²³⁾

The present study does not agree with an investigation that found no difference in the prevalence of delays in term versus late preterm infants.⁽²⁵⁾

However, other medium- and long-term neurodevelopmental problems (of lesser severity but greater prevalence than the above) have become the focus of attention of health and educational professionals and families themselves. Ophthalmological problems, hearing deficits of varying severity, neuropsychological and learning disorders, autism spectrum disorder, attention deficit hyperactivity disorder, and conduct and behavioral disorders are significantly more prevalent than in the general population and may be present in up to 50% of large preterm infants.⁽²⁶⁾

The article "La importancia del neurodesarrollo en niños menores de treinta meses en el contexto peruano" explains that neurodevelopmental assessment is a basic activity in child care services and concludes that the prevention of possible delay and the recovery of children at risk will contribute to poverty reduction and equity because children will be able to acquire capacities and capabilities that ensure an adequate quality of life for themselves and their families and to contribute to the economy and development of the country.⁽²⁷⁾

Very low birth weight newborns will be those at greatest risk of presenting malnutrition in early childhood and those with the greatest impact on neuropsychomotor development. Herein lies the importance of including them

in high-risk follow-up programs to ensure regular monitoring of their somatic growth and to act as soon as possible with the greatest effectiveness.⁽¹³⁾

CONCLUSIONS

At one year of corrected age, most of the very low birth weight infants had some degree of growth and developmental delay. When compared to infants without perinatal risk, slightly more than one third of the infants born with very low birth weight presented some degree of malnutrition and about half of them had weight, height and head circumference lower than those corresponding to children without perinatal risk. As birth weight increased, the risk of non-recovery of weight, height and head circumference at one year of age decreased. One third of the children had delayed psychomotor development at one year of age and the majority had inadequate tooth eruption.

We recommend the need to strengthen follow-up consultations of high-risk neonates, with emphasis on growth and neurological development, and thus evaluate the level of effectiveness of neonatal care.

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CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

CONTRIBUTION OF THE AUTHORS

IMM: conceptualization, formal analysis, methodology, data curation, visualization, research, project management, writing the original draft.

ORMM: conceptualization, formal analysis, methodology, data curation, project management, supervision, resources, validation, visualization, research, writing the original draft, writing (reviewing and editing).

AMCM: formal analysis, methodology, validation, supervision, writing the original draft, writing (review and editing).