LOW BIRTH WEIGHT:

CLINICAL IMPLICATIONS*

*Pedro Daniel Páez***

Maternidad "Concepción Palacios", Caracas, Venezuela

SUMMARY

At present, the study of pre-term babies (prematures) has acquired special interest, mainly due to the great scientific advances achieved in this field, and because of their complicated handling, and the high risks implied by incorporation of the survivors to the society we live in.

Retardation in fetal development observed in the Latin American countries is the first cause of neonatal mortality, of perinatal clinical implications and of sequelae in the child's development, furthermore, it is a conditioning factor of postnatal mortality and morbidity.

This group of *in utero* malnourished babies or small-for-date infants, merits particular interest, since it is the most unfortunate group of newborns, especially in what concerns their future mental development.

Results of a statistical and clinical analysis of the characteristics that define low birth weight babies are given.

Finally, a series of recommendations with obstetric, perinatal and pediatric implications are provided, all of which tend to improve medical assistance for this group of newborns.

I. INTRODUCTION

The study of infants born with less than 37 weeks of gestation has taken great importance in the course of the past years, with the appearance of perinatology, as a

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** Assistant Director of the Neonatal Intensive Therapy Unit, Department of Pediatrics of the Maternidad "Concepción Palacios", Caracas, Venezuela.

discipline which analyzes in depth the obstetric and pediatric events that take place around parturition. This concern has led to a greater knowledge of these phenomena which are directly reflected in the future of the newborns with the consequent implications for the community that watches over their physical, mental and social welfare.

A low birth-weight or premature baby has been traditionally accepted as a child whose weight is 2,500 grams or less. However, with the incorporation of the gestational age parameter,[1] a new classification has been suggested that groups them as follows: pre-term, at term and post-term babies, according to whether their birth takes place before 38 weeks, between the 38th and 42nd weeks, or after 42 weeks, respectively. In turn, each of these categories is subclassified in small, adequate or large for its gestational age, if his weight is below the 10th percentile, between the 10th and 90th percentile, or above the 90th percentile, in that order. Some authors only speak of small for their gestational age when children are born below the third percentile according to their weight.[2,3]

II. INCIDENCE

In the developed countries, approximately 8% of all babies born alive weigh from 1,500 to 2,500 grams, which correspond to a gestational age of 31 to 36 weeks, with a neonatal mortality of 2 to 8%.

If we consider only the children who at birth weigh from 500 to 1,500 grams and who correspond to the 24-30 weeks of gestation group, we find that neonatal mortality rises up to 70%. The magnitude of this problem acquires greater evidence when these figures are compared with those of neonatal mortality observed in at term newborns, which is of 0.2%.[4]

In Costa Rica, babies weighing less than 2,500 g at birth represent from 12 to 15% of all born-alive babies, and 15% in Colombia.[5]

In a recent study carried out in a rural community of Guatemala, 48% of the newborns whose average weight was 2,564 grams were found, with a neonatal mortality of 8%.[6]

Besides, congenital malformations incompatible with life are more frequent in premature infants. The majority of the deaths occurring in this group with a birth weight under 2,500 g, are due to the "Respiratory Distress Syndrome" on account of pulmonary immaturity of the lungs or hyaline membrane disease. Sequelae, especially of neurologic order, affect these prematures in a transitory or definite form after parturition, in a greater proportion than at term newborns.[7] The greater the degree of prematurity, the greater the incidence of mortality and sequelae.

III. CLINICAL CHARACTERISTICS OF LOW BIRTH WEIGHT INFANTS

The perinatal *asphyxia* represents a frequent problem in pre-term newborns,

and is fundamentally explained by the degree of immaturity of the nervous system, cerebral hemorrhages, *infections* and fetal injury.

These babies need external help to control the *temperature.* In view of the impossibility of producing heat through muscular contractions, they use its chemical thermogenesis mechanism which is activated by the action of epinephrine on the brown fat. This system starts functioning every time that the child is below its thermic neutral zone (37°C).

Nutritionally, they are at disadvantage since their gastric capacity is limited, the incomplete myelinization of the nervous system prevents a good motor function of the digestive system and, lastly, their caloric requriments per kg of weight are high (120-150 calories/kg/day after the first week of life). That lack of caloric supply generates malnutrition situations which are fundamentally reflected in the nervous system, a problem that is more accentuated in the newborn with a weight below 1,500 g, especially if other problems are associated to it. Multiple food systems have been designed which vary from parenteral hyperalimentation, whether this is performed with hyperosmolar or iso-osmolar solution, "gavage", to continuous transpyloric feeding. All of them require specialized personnel and equipment, since they are not free from complications. In some specialized centers, mother's milk is being administered which benefits the neonate from the well-known immunologic protection from infections of the respiratory and gastrointestinal tract.

From the *respiratory* point of view, if the newborn has less than 37 weeks of gestation, its alveolar surfactant content with tensoactive properties (lecithyn) will be reduced, and this leads to atelelectasis, hypoxia and death. The Hyaline Membrane Disease will occur in 10% of the newborns with less than 2,500 g, with a neonatal mortality of about 20% in the more specialized centers equipped with intensive care units,[8] and 80% in the less well-equipped centers. The aspiration syndrome and the pulmonary and retinal complications of hyperoxia also occupy an important place in the morbilethality of these neonates.

Jaundice is particularly common in this age group, partly due to hepatic immaturity and partly because of their low plasma albumin content. It is a well-known fact that the frequent acidosis and hypoxia situations make the neurone more vulnerable to the neurotoxic effect of indirect bilirubin, with the consequent possibility of a greater incidence of *kernicterus.*[9]

There is a deficient absorption of minerals such as calcium, magnesium, copper, zinc,[10] which explains the frequent tetany episodes.

The hemoglobin concentration in pre-term fetuses is diminished, and so is the erythropoietic activity; also, the red cell membrane is more susceptible to peroxidation and destruction due to the transitory deficiency of tocopherol (vitamin E).[11, 12] All of these factors contribute in one way or another to the *anemia* of the premature.

The carbohydrate stores of the pre-term child are lower than those of the at term newborns, and this conditions *hypoglycemia* situations in the first hours of life.

Pre-term newborns have another obstacle to surpass: *infections.* Their immunologic system is not altogether developed; there are immunoglobulin A deficiencies which they acquire at an early date through the maternal colostrum; the immunoglobulins M do not cross the placenta, thus placing them at disadvantage, mainly against gram-negative germs. The *acute necrotizing enterocolitis,* with its high mortality, is rather common in newborns with a history of hypoxia, prematurity, Hyaline Membrane Disease, umbilical catheterization, and patent *Ductus arteriosus.*

IV. SMALL FOR GESTATIONAL AGE

As mentioned previously, this group of newborns is under the 10th percentile for their weight and gestational age. The incidence of morbi-mortality in them is higher than in any other group of newborns.

Studies carried out in the United States of America and Great Britain establish that approximately 30% of the newborns weighing less than 2,500 g are not real prematures, but small for their gestational age.[13] For the Latin American countries, this figure is of approximately 60%, being such low weight the first cause of perinatal death.

Interest for studying these groups of newborns started in 1963 when Gruenwald[3] wrote in regard to the "Chronic fetal suffering and placental insufficiency." Then, in 1968, Dobbing established that the brain is permanently affected from the intellectual and neurologic points of view when there is malnutrition during its rapid growing phase, especially during the third trimester of pregnancy.[14]

The incidence of congenital malformations is 1.5% in pre-term babies, particularly if these are malnourished *in utero,* which suggests the existence of a genetic factor in its etiology. In addition there is a conjunction of factors that include maternal, environmental, placentary and fetal aspects which try to explain their etiology, very well described in the literature.[15,16]

A study of 96 children born with a weight under the 10th percentile who were followed during six years fundamentally to analyze the course of their growth and development was carried out. We shall now describe only the most salient aspects. The general growth pattern was the same for pre-term and at term babies, with a greater growth velocity in the first six months in the malnourished *in utero.* A significant retardness in their weight and height occurred, noting, for example, that at the age of six years 35% of them were under the third percentile for their weight and height and only 8% were over the fiftieth percentile. The bone age was under the third percentile in half of the children included in the study.

In 25% of the cases minimal cerebral disfunction was observed. The electroencephalographic tracing was abnormal in 70%, while the percentage of abnormalities in the control group was 27%. School performance was poor in 40% of the children who, in turn, presented a 30% language deficit.

A whole conglomerate of physiologic changes can be appreciated in these children in function of their gestational age, which can be summarized as follows:

1. Acceleration of pulmonary maturity, a fact that explains the lower incidence of disease of the hyaline membrane.
2. Retardness in the epiphiseal ossification centers.
3. Minimal weight loss during the neonatal period.
4. High hemoglobin values.
5. Increase of the plasmatic volume.
6. Increase of the extracellular fluid.
7. Increase of the nonprotein nitrogen.
8. Hypo- and hyperglicemia.
9. Thymic atrophy.
10. Thin ribs with production of spontaneous fractures.
11. Late anemia.
12. Increase of the metabolic activity/kg weight.
13. Limited thermoregulation capacity.
14. Normal or reduced immunoglobulin G.
15. Increased immunoglobulin M in case of infection.
16. Greater incidence of asphyetic problems.

Special efforts are presently concentrated in the study of the future of these children, particularly with regard to their growth and development. It has been proved that the development of a small for gestational age child runs parallel to that of any premature baby adequate for its gestational age if they are in an environment that stimulates them to progress physically and mentally.[14] Studies on the intellectual

coefficient of these children failed to establish any correlation: it is concluded therefore that this parameter is not helpful for the characterization of these infants.

V. IMPLICATIONS AND SUGGESTIONS

Obstetric

The best solution to the problem of low birth-weight newborns is to avoid the occurrence of these types of births, or at least that their number be reduced. Multiple variables can be modified to achieve this purpose, among which the following are mentioned: promotion of health and hygiene of the mother; prevention, diagnosis and early treatments of infectious and metabolic diseases; stimulation of maternity at an optimal age, with greater interval between pregnancies, suggesting an adequate number of pregnancies in accordance to the mother's possibilities and, finally, imparting education on perinatal events.

Perinatal

This part refers to an adequate attention of parturition with participation of the obstetrician, anesthesiologist and neonatologist, thus integrating a team of such a type as to permit decision-taking and implement working plans from which the future of the newborn shall depend. These objectives have certain implications such as: complete perinatal evaluation on the part of the members of the medical team; presence of the neonatologist or pediatrician trained in the attention of the critical neonate in every act leading to the birth of a child at high risk; availability of adequate reanimation equipment; assigment of a regional neonatal reference center with participation of the more complete obstetric-pediatric institution in the areal zone, for handling the more difficult cases. and, finally, availability of a statistical evaluation system that permits making a precise diagnosis of the perinatal problem.

Pediatric

Analysis of the events that occur after parturition is of vital importance to ascertain the magnitude of the sequelae that remain as product of the survival of so many neonates that years back were destined to die. To achieve this goal the following is required: a complete perinatal history; establishment of referal centers for the follow-up at short and long term of the high-risk newborns; availability of facilities that allow these children to benefit from the early stimulation programs and, finally, enrollment of all lactating mothers in the La Leche International League.

RESUMEN

BAJO PESO AL NACER: IMPLICACIONES CLINICAS*

El estudio de los niños pre-término (prematuros) ha adquirido especial interés

en nuestros días, principalmente debido a los grandes avances científicos logrados en este campo, lo complicado de su manejo, y los grandes riesgos que implica la incorporación de los sobrevivientes a la sociedad en que vivimos.

El retardo en el desarrollo fetal observado en los países latinoamericanos es la primera causa de mortalidad neonatal, de patología perinatal, y de secuelas de desarrollo del niño; además, es un factor condicionante de la mortalidad y morbilidad post-neonatales.

Particular interés reviste el grupo de los desnutridos *in utero* o pequeños por edad gestacional, por tratarse de que éste es el grupo más desafortunado de recién nacidos, especialmente en lo que a su futuro mental concierne.

Se dan a conocer los resultados de un análisis estadístico y clínico de las características que definen a los recién nacidos de bajo peso al nacer.

Finalmente se formula una serie de recomendaciones con implicaciones obstétricas, perinatales y pediátricas, tendientes a mejorar la asistencia médica de este grupo de recién nacidos.

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