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EDITORIAL

Importance of screening tests for neurodevelopmental evaluation in children

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INTRODUCTION

Growth and development are attributes that define childhood and begin during pregnancy. Growth first corresponds to the complex deposition of molecules in each of the organs and tissues that will give a body composition expressed in a synchronous gain of weight and height.[1] Development corresponds to the acquisition of functions of each of the organ. These specifically emphasize the functions of the entire nervous system including the sensory organs. The expected acquisition of these functions will be reflected in maturity and organization. During their interaction with the surroundings, they generate behaviors and experiences that will stimulate the potential of their abilities, producing various skills that will be the essence of human life. Growth and development are different clinical expressions but not distinct because both comprise an inseparable unit. Empirical knowledge of growth and development has always been part of the experiences of humans. These attributes of children advance in parallel and are interdependent. Both are time-dependent and enriching environmental experiences. However, measurements of these expressions have not been documented for a long period of time. At this time, we will not address the issue of how to measure and evaluate physical growth but instead comment on the article by Rizzoli-Cordoba et al. published in the current issue of *Boletín Médico Hospital Infantil de México* (*BMHIM)* that attempts to validate an instrument for the detection of developmental problems in children.[2] This will be a prelude to the theme of neurodevelopment in children.

Interestingly, one of the tools to assess this phenomenon is the measurement of physical growth because nutritional status is an environmental factor that influences the expression of development. With the knowledge of both growth and development, these may be affected by genetic and environmental factors. It has been important to establish whether child development has occurred within normal limits from the time of gestation or has varied from these conditions. The human brain and sensory organs, mainly the ear, are the most susceptible to damage. Therefore, it is important to determine whether in utero, at the time these organs are formed and begin the acquisition of their duties, they have been exposed to environmental factors capable of producing damage. Adverse factors are socioeconomic with inequality in practical terms called poverty, which signifies neglect with professional care during pregnancy along with maternal malnutrition. Unhealthy environments of poor families expose pregnant women to be in contact with substances such as lead, mercury and pesticides that negatively affect neurodevelopment in their children. These compounds have a low molecular weight with high affinity for lipids and no polarity that prohibits protein binding. These are characteristics that allow them to cross the placental barrier, reach the fetal circulation and cross the hematoencephalic barrier, attaching themselves to immature brain cells whose detoxification capacity is reached postnatally. Lead mimics calcium ions and, therefore, crosses the hematoencephalic barrier with relative ease.[3] Methylmercury combines with cysteine to form a com-

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pound structurally similar to the essential amino acid methionine. This compound, methylmercury-cysteine, is actively transported in the endothelial cells of the hematoencephalic barrier using methionine as transportation with a glutathione transporter with which it reaches the brain.[4] In the same way, pesticides such as polychlorinated biphenyls and others also have access to brain tissues due to their lipid solubility. It is important to remember that exposure of the brain to potentially harmful substances apparently does not have short-term consequences due to the rapid acquisition of several other functions. However, this does not mean that they cannot be expressed later.[5] In order to obtain information in regard to these potential effects, cohort studies and tests are indispensable to evaluate neurodevelopment. A separate chapter discusses inadequate prenatal care, which can lead to low birth weight and asphyxia, affecting psychomotor development.[6] Along with environmental factors, we must add the lack of some micronutrients such as iodine and lack of or insufficient intake of micronutrients associated with anemia in the first year of life, such as iron, folic acid or vitamin A, producing delay of psychomotor development, which is presently considered irreversible.[7]

As is known, timely identification of the risk of brain damage, which is expressed in neural development abnormalities and that will have negative repercussions in children's learning regardless of the cause, has proven to be challenging. In Mexico, no precise figures are known of the number of children who present with some degree of damage (due to poverty or to asphyxia/neonatal hypoxia or anemia). However, the numbers are high, resulting in a public health problem. This is one reason for the necessity of an early detection test for neurodevelopmental damage in children. These tests must be standardized according to age and gender. Regardless of the damage that can be specifically identified, we should consider the cultural and socioeconomic environment. This is particularly important for studies or evaluations carried out in children who come from cultural backgrounds different from the location where the test is administered. However, these tests are indispensable for children with apparently no risk because any neurodevelopmental alterations should be detected. Screening tests made available to the primary care physician should be simple tools whose application is not time consuming. Results should be reliable for monitoring child development at critical stages corresponding to the first years of life. This task has been the focus of the study by Rizzoli et al.[2] However, their study is very broad and with little information about the original and modified instruments as well as providing little information about the procedures with extensive descriptive and comparative results.

The results of the Child Development Evaluation (CDE) are compared using as a reference the 2nd edition of the Battelle Scale as diagnostic. Results are not shown when compared to the Bayley III scale. The main feature of screening tests such as the CDE is that they have an acceptable specificity, i.e., a negative CDE actually corresponds to an individual without neurodevelopmental alterations.[8] However, both in the original and the amended version, the CDE showed a low specificity, although the modified version showed a slight improvement in this regard. Furthermore, the specificity of this test in the group of children 0- to 15-months of age and 16- to 60-months of age is the lowest compared with other screening tests applied in the U.S., Chile and Argentina. Moreover, there was not a subsample in which children with impaired CDE were studied with neuroimaging or electroencephalographic studies to confirm the damage, which ultimately constitutes the real validation.

In the Discussion section, the study sheds some light on the differences in the original and amended CDE, but does not discuss them in detail. It would have been desirable to learn about the experience of the evaluation of neurodevelopment in Mexican children[9,10] or at least the advantages or disadvantages of other tests such as the "so-called" Neurobehavioral Rating Infant Development (VANEDELA). The latter is an instrument designed for the early detection of risk for neurological and developmental disorders, validated for the healthy Mexican childhood population. It has also served for the early detection of neurodevelopmental sequelae in children with perinatal encephalopathy.[11,12] Early identification of developmental issues must give way to directing these children towards medical services and integrate them into multidisciplinary monitoring programs for evaluation, diagnosis and treatment. It is possible that many of these children require special care and attention because developmental abnormalities are associated with other underlying problems. Caring for the health of these children and, in particular, their neurological development, is an essential and urgent task. So far, in Mexico, the greatest efforts have been directed to the rehabilitation of children with neurodevel-

opmental delays, sequelae or some type of disability, but often these efforts are too late. Therefore, it is important to consider that it is the responsibility of the Mexican government, but also of society as a whole, to promote healthy environments and empowered families as caring stewards of the health of all family members and to emphasize the importance of prevention.

However, neurodevelopment not only encompasses delayed development. The opposite situation also exists: children with exceptional talent for learning sciences, arts, humanities and other fields of human knowledge. What are the characteristics of their development that identify them and place them in environments where they can achieve the full development of their abilities? What are the educational and household risks that we must first identify? Are they living in harsh environments? Unfortunately, to date, little or nothing is known about how to identify genius and gifted children. This is one aspect of the poverty of our developing society: lack of tools and programs to offer children at the extremes of the neurodevelopmental curve.

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